## **NOTICE**

All drawings located at the end of the document.

# Resource Conservation and Recovery Act Post-Closure Care Permit Application

For U.S.D.O.E.-Rocky Flats Plant Hazardous & Radioactive Mixed Wastes

CO7890010526

5 October 1988

Volume IV



By A-SW-000286

**ADMIN RECORD** 

# Resource Conservation and Recovery Act Post-Closure Care Permit Application

For U.S.D.O.E.-Rocky Flats Plant Hazardous & Radioactive Mixed Wastes

CO7890010526

5 October 1988

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Prepared by:

ROCKWELL INTERNATIONAL

North American Aerospace Operations

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APPENDIX F-1
TANK INSPECTIONS

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HAZARDOUS AND MIXED WASTE RESOURCE CONSERVATION AND RECOVERY ACT STANDARD OPERATING PROCEDURES

#### F-1 INSPECTION OF TANKS

The tank inspection provisions require development of a schedule and procedure that provides a detailed inspection of the overfill controls of the tank. In addition, a daily inspection of aboveground tank systems, including instrumentation and the secondary containment structure is required. All observations are to be recorded in the inspection log.

Examples of items that should be considered for inclusion in the inspection plan are:

- Determination of appropriate pressure/vacuum vent setpoint.
- o Seating of vent seals.
- o Foreign materials in roof drains.
- o Inlets/outlets for blockage or corrosion.
- o Seals on:
  - manholes
  - gauge hatches
  - inlet/outlet nozzles or flanges
  - weather shields
  - level gauges
- Liquid level sensing system activated at proper present level.
- All valves operating properly.

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- o Visual and audible alarms functioning properly.
- o Flow-rate controls.
- o Temperature gauges.
- o Pressure gauges.
- o Controls.
- o Analyzers.
- Alarms and emergency shutoff devices.
- o Transmission systems.
- o Power supplies.
- o Panels and enclosures.
- o Pumps.
- o Electrical equipment.
- o Insulation.
- o Enclosures.
- o Bearings,
- o Other operating mechanisms.

Overfilling control systems will typically consist of some type of liquid level monitoring device with an output signal that is used to close an inlet valve, open a by-pass valve, or sound an alarm. In some cases, however, the overfilling control equipment may simply be a hook gauge, tape-and-plumb bob, or manometer which is periodically visually checked. The regulation requires sufficiently frequent inspection of

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these control systems to ensure their proper operation. Where practical, daily inspection of overfill controls should be performed simultaneously with the <u>required</u> daily tank inspection.

Specifics of inspecting these areas on an appropriate schedule will not be separately discussed.

### F-la Daily Inspections

Daily inspection of the aboveground portions of the tank system for corrosion or leaks from tank fixtures, joints, flanges, pumps, valves, and seams, and daily inspection of leak-detection systems must be performed for tank systems by operators.

In most cases, instruments and controls are visually inspected daily by the operator, since they are an integral part of the daily operation of the facility. Any unexpected discontinuities or abnormal peaks in data charts or data logs may indicate that there is some cause for concern. All instrumentation and control equipment should be thoroughly inspected according to the manufacturer's recommended frequency and methodology. Environmental conditions, such

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as heat, moisture, chemical attack, and dirt, are responsible for deterioration of electrical systems. The inspector should specifically look for these deteriorating effects.

Gross leakage or corrosion from fixtures and seams will be readily evident. This is the primary purpose of a daily visual inspection. Stress corrosion around weld seams, joints, and fixtures may occur on the surface of the tank. Careful daily inspection of aboveground portions for corrosion will usually allow detection of potential defects, which then will require further detailed examination. Visual inspections are usually sufficient to locate major corroded areas on aboveground portions of the tank.

In addition to daily inspection for corrosion, the aboveground portions of the tank shell should be inspected for leaks, cracks, buckles, and bulges. Discoloration of paint may be an indication of leakage.

Cracks can be found at nozzle connections, in welded seams, and underneath rivets. Cracks, buckles, and bulges can initially be spotted by visual inspection, and their extent can be more thoroughly determined by other techniques.

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All valves and related mechanical equipment immediately related to the tank system should be visually inspected to ensure that the seating surfaces are in good condition. Specific guidance for these inspections is given below.

### F-1b Valves, Pipes, Fittings, and Hoses

Inspection of valves, pipes, fittings, and hoses is critical to detect losses in metal thickness owing to external or internal deterioration. In many cases, high liquid turbulence or velocity causes these parts to erode or wear. Leaks are most likely to occur around pipe bends, elbows, tees, and other restrictions, such as orifice plates and throttling valves. Loading and/or unloading hoses used as flexible connections between vehicles and storage tanks are vulnerable to wear and tear as well. Traffic passing over hoses during loading and unloading can also contribute considerably to hose deterioration.

Visual inspection while the tank is in operation should include checking for the following:

- o leaks
- o misalignment of pump shafts
- o unsound piping supports
- o vibration or swaying

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o indications of pipe fouling (causing flow restrictions)

- o external corrosion
- o accumulations of liquids

Specific areas that should be checked for the above conditions include:

- o pipe bends
- o elbows
- o tees
- o orifice plates
- o throttling valves
- o loading/unloading hoses
- o pumps

Pipe connections in tank systems should be inspected for external corrosion by visual examination. Piping should occasionally be scraped and cleaned during visual inspection. When the tank has shown evidence of excessive settling, piping connections that might have been loosened should be carefully checked.

Film lifting of the tank's protective coating is prevalent below seam leaks and is best detected, as are rust spots and blisters, by visual inspection, aided by scraping the film in suspected areas where necessary. Special attention should be paid to paint blisters, which are usually prevalent on the roof and the sunny side of outdoor tanks.

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## F-1c Pumps and Compressors

Although mechanical wear is the primary cause of deterioration for pumping and compression equipment, erosion and corrosion can also be contributing factors. Improper operating conditions, piping stresses, cavitation, and foundation deterioration causing misalignment have been known to contribute to deterioration.

Routine visual inspections of pumps and compressors should include the following:

- o foundation cracks and uneven settling
- o leaky pump seals
- o missing anchor bolts
- o leaky piping connections
- o excessive corrosion
- o excessive vibrations and noise
- o deterioration of insulation
- o excessive dirt
- o a burning odor or smoke
- o missing safety equipment such as a pump-coupling guard
- o depleted lubrication oil reservoir

Vibration has been known to deteriorate a pump or compressor rapidly; therefore, periodic observation or electronic measurement of the vibration level should be conducted. All assembly bolts, gaskets, cover plates, and flanges should be inspected as well to detect leaks and cracks.

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When a pump or compressor is taken out of use, the mechanical components should be checked for clearance, corrosion, erosion, deformation, wear, and any other changes detrimental to safe operation.

#### F-1d Foundation Inspection

Concrete curbing around the base of the foundation and foundation ringwalls should be inspected for signs of deterioration. Cracks or decay should be repaired promptly to maintain structural integrity and to prevent the leakage and collection of liquids under the tank. Concrete pads, base rings, piers, column legs, stands, and any other general support structures should be visually examined for cracks and spilling. Such deterioration can also be uncovered by scraping the suspected areas. The joint between the tank bottom and the concrete pad or base ring may have a seal for stopping water seepage. If so, this should also be inspected for corrosion. Wooden supports for tanks should be checked for rotting by hammering. Anchor bolts can also be checked for structural integrity and tightness by hammering. Anchor bolts can also be checked for structural integrity and tightness by hammering. Excessive foundation settlement is typically indicated by

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distortion of anchor bolts, buckling of columns, and

excessive concrete cracking. Welds along the angle iron at

the intersection of the shell and tank bottom should be

inspected for deterioration as well.

F-le Secondary Containment Inspection

Secondary containment structures, including paint, liners,

and double-walled tanks or other approved structures should

be regularly inspected for signs of structural integrity,

and erosion or corrosion.

Polymeric liners are often used for secondary containment.

These liners have particular properties that should be noted

during an inspection. Polymeric liners are subject to:

risk of puncture;

2) damage from vehicular traffic;

attack by sunlight and ozone;

4) attack by hydrocarbon solvents.

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F-1f Fiberglass Reinforced Plastic (FRP) Tanks

Corrosion is the major cause of failure in metal tanks. FRP

tanks, however, are more likely to fail due to reaction,

softening, swelling, or cracking than from corrosion.

Aboveground reinforced plastic tanks should be inspected for

cracking due to bending, curving, or flexing after delivery

and throughout the service of the tank. Excess pressure can

result in structural failure, evidenced by interior

longitudinal cracking in horizontal tanks and by vertical

cracking in vertical tanks. A dye-penetrant testing method

can be used to investigate suspected cracks.

The metal appurtenances of a fiberglass or epoxy tank should

be inspected according to the schedule discussed earlier.

These metal parts may corrode or break and must be

inspected.

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## APPENDIX F-3

INSPECTION LOGS FOR SECURITY, EMERGENCY RESPONSE AND SAFETY EQUIPMENT

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### ROCKY FLATS FIRE DEPARTMENT EQUIPMENT CHECK LIST AMBULANCE #1 227

## DAILY CHECK OF THE FOLLOWING ITEMS:

-ITEM	мо	TU	WE	TH	FR	SA	su	COMMENTS
	!	!	!	<del></del>	!	!		!
		<del></del>	!	!	!		<del>}                                    </del>	<del></del>
	<del></del>	<del>!                                    </del>	!	•	!		<del>-</del>	<del> </del>
	<del></del>	<u> </u>	!	<del></del>	<del></del>	<del>-</del>	<del>!</del>	<u> </u>
Siren/horn	<del>.                                      </del>	<del>!                                    </del>	<del>-</del>	<del></del>	!		<u> </u>	<del> </del>
Radio check	<del>!                                    </del>	<del>.                                      </del>	<u> </u>	•	•	<del></del>	•	<u> </u>
Windshield wipers	!	!	!	!	!	!	!	!
Parking brake	!	!	!	!	!	!	!	
Flashlights	!	!	!	!	!	!	!	
Booties	!	!	!	!	!	!	!	
	!	!	!	!	!	!	!	
Turn signals	!	!	!	!	!	!	!	
Emergency lights	!	!	!	!	!	!	!	
Spotlights	!	!	!	!	!	!	!	
Flood lights	!	!			!		!	
Fog lights	!	!	!	!	!	!	!	
House 02 pressure	!	!	!		!	!	!	
Portable suction function	!	!	!	•	!	!	!	
Portable 02 funct./press.	!	!	!	!	!	!	!	<u> </u>
Resuscitator funct./press.	!	•	!	!	!	!	!	!
Life-pack 5 scope function		!	!	!	!		!	!
Paddles to 300 joules	!	!	!	!	!	!	!	!
Apcore radio test	!	!	!	!	!	!	!	!
Clean sheets on litter	!	•	!	!	!		!	
Visual cabinet check	!	!	!	!	!	!	!	
Visual trauma kit check	!	!	!	!	!	!		
Respirators	!		!	!	!			
Tires	!	!		!	!			
MONDAY CHECK OF THE FOLLOW	ING	IT	EMS	<u>:</u>				
Inventory all equipment	<u>!</u>	!						
CXCT.120131161	!	!						-
Exhange Life-pack batt.	i	ì						
with batt. in chargers	!	!						
		!						
Operate resque tool	!	!						
SATURDAY road test							!	
FUEL-UP CHECK OF THE FOLLO	WIN	G I	TEM:	<u>s:</u>				
Engine oil level	!							
Madiato: IIVCI	!							
	!							
Tire pressure	!							

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## ROCKY FLATS FIRE DEPARTMENT MONTHLY BUILDING SURVIVAIR INSPECTION

GROUP-1 [SECTION 1A]

SHIFT ASS	GIGNED:			MONTH OF:
INSPECTED	AND TESTE	D BY:		
MONTHLY I	NSPECTION	C 3 8	SEMI-ANNUAL [	] ANNUAL [ ]
		: CYLINDER : PRESSURE		COMMENTS
571-1	:	1	1	
371-2	:	!	:	
37,1-3	;	i	;	
: 571-4	:	!		
; 371-5		i	!	·
; : 371-6	!	¦	!	
; : 371-7	!	! !	!	
371-6	:	!	!	
: 371-9	†	!	!	, , , , , , , , , , , , , , , , , , ,
371-10	!	!	!	
371-11	!	!	!	
371-12	1	!	!	
371-13	!	!	!	
371-14	!	!	!	
371-15	:	!	<u> </u>	
371-16	!	:		
371-17	:	;	!	
371-18	!	!	!	
,			~	

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# ROCKY FLATS FIRE DEPARTMENT FIRE PREVENTION INSPECTION AND TEST RECORD MONTHLY SPRINKLER CONTROL VALVE INSPECTION

GROUP-1 [SECTION 1A]

NUMBERS	INSPECTED	AND TES	STED BY:_		
SPRINKLER, DELUGE AND STANDPIPE SYSTEMS    BLDG.	SHIFT ASS	IGNED:			MONTH OF:
BLDG. : : NORMAL : PRESSURE : SYSTEM : DEVICE : DELTA : PRESSURE READINGS : READINGS 2": ALARM NUMBERS : NUMBER : NUMBER: WATER : AIR : NITROGEN! DRAIN TEST : TESTE! 111A : FFL-007 : 42303 : : N/A :	HAVE ALL	ALARMS B	BEEN LOGG	ED: YES_	NOX
SYSTEM : DEVICE : DELTA : PRESSURE READINGS : READINGS 2": ALARM NUMBERS : NUMBER : NUMBER: WATER : AIR : NITROGEN: DRAIN TEST : TESTE!  111A : FFL-007 : 42303 : : N/A	·	SP	RINKLER,	DELUGE	AND STANDPIPE SYSTEMS
SPRINKLER CONTROL VALVE NUMBERS  CONTROL VALVE   COMMENTS: NUMBERS   OPEN   CLOSED    111A-1 PIV      111A-2      111A-3      111A-4 PIV	SYSTEM	DEVICE	: DELTA	: PRE	SSURE READINGS : READINGS 2": ALARM
CONTROL VALVE   COMMENTS:	111A	:FFL-007	7   42303	; ;	! N/A : N/A: N/A : N/A : NO
111A-1 FIV				1	-: COMMENTS:
111A-2	; : 111A-1	PIV :		!	
111A-3	: 111A-2	:		;	;
: 111A-4 FIV : : :	111A-3	:		:	
	: 111A-4	PIV :		:	
: 111A-5	: 111A-5	:		:	;
	:	•		!	1
	1	:		;	•

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# ROCKY FLATS FIRE DEPARTMENT GROUP-1 FIRE PREVENTION INSPECTION AND TEST RECORD GECTION 143 I INCH DRAIN TEST, ALARM TEST AND VALVE INSPECTION

INSPECTED	AND TE	STE	D BY:										
SHIFT ASS	IGNED:						MO	NTH (	OF:				
HAVE ALL	ALARMS	BEE	N LOGGE	ED:	YES	N	10						
	9	SPR II	NKLER,	DEL	UGE AI	TZ DV	'AND	PIPE	SYST	EMS			
BLDG. System Numbers	: DEVIC	CE :	DELTA NUMBER	;	PRES	SURE	REA	DING	5 :	READI	NGS :	2":	ALARM :
111A				;	;	N/A	1	N/A:	N/A:			:	
·			SPRIN	KLER	CONTI	ROL V	'ALV	E NUI	MBERS				
CONTROL NUMBERS	VALVE	; 0	FEN	: CL	OSED	: c	OMMO:	ENTS	:				
													;
111A-2		:		:		:							
111A-3		:		!		:							
111A-4	FIV			<b>;</b>		;							;
111A-5		:		1		,							
													•
! !		1		:									
						;							

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## ROCKY FLATS FIRE DEPARTMENT SEMI-ANNUAL CO2 SUPPRESSION SERVICING AND TESTING

[GROUF-1] INSPECTED AND TESTED BY: SHIFT ASSIGNED: MONTH OF:\_\_\_\_\_ HAVE ALL ALARMS BEEN LOGGED: YES\_\_\_\_ NO\_\_\_\_ BUILDING NUMBER: 127 DEVICE NUMBER: FCO-003 ALARM NUMBER: 42411 LOCATION OF SYSTEM: BY THE SOUTHWEST CORNER OF BUILDING 121. SIZE OF HYDRO MAIN OR CHECKED BY CHECKED BY TYPE CYLINDERS DATE RESERVE WEIGHT LIQUID LEVEL C02 50 LBS. 1979 002 50 LBS. 1973 C02 50 LBS. 1973 ------CC2 50 LBS. 1973 -----PILOT BOTTLE PRESSURE PRESSURE SIZE OF HYDRO CYLINDER DATE READING READING TYPE DATE HIGH SIDE LOW SIDE CB2 COMMENTS:

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## ROCKY FLATS FIRE DEPARTMENT BUILDING MANUAL FIRE ALARM STATION TESTING [GROUP 1]

INSPECT	TED AND	TESTED	BY:		
SHIFT A	ASSIGNE	):		MONTH OF:	JANUARY

- (1) HAVE ALL ALARMS BEEN LOGGED: YES\_\_\_\_ NO\_\_\_\_
- (2) FLACE BELL FANEL IN TEST MODE.
- (3) HAVE BELL PANELS BEEN PLACED IN NORMAL OPERATION AFTER TESTING AND PANELS LOCKED: YES\_\_\_\_\_ NO\_\_\_\_

BLDG.	DEVICE	DELTA	LOCATION
111	F-063	42001	IN BASEMENT HALLWAY, BY ENTRANCE TO REPRODUCTION AREA.
123	F-071	42009	NORTH HALLWAY, BY WEST ENTRANCE TO BUILD- ING. DOOR # 8.
125	F-062	42607	IN ROOM 144. SOUTH DOCK ENTRANCE TO BUILD- ING. DOOR # 3.
251	F-251-1 HE	ADQUARTERS	(FULL STATION) ZONE-1. BY WEST ENTRANCE TO MAIN EAST/WEST HALLWAY.
T334B	FSD-45-1	<del></del>	SOUTH ENTRANCE TO TRAILER.
371	F-035	10103	SUB-BASEMENT ROOM 1006.SOUTH SIDE [CENTER] OF BUILDING BY STAIRWAY # 2.
371	F-019	10902	1ST FLOOR HALLWAY 3002, WEST END OF SUP- PORT OFFICE AREA BY SOUTH DOOR # 23.
371	F-057	11411	1ST FLOOR INSIDE ROOM 3513. MAIN EAST/ WEST HALLWAY [CENTER] ON NORTH SIDE.
371	F-045	11708	1ST FLOOR ROOM 3032, MAIN EAST/WEST HALL- WAY. BY INCINERATOR CONTROL ROOM.
374	F-001	12402	BASEMENT ROOM 2801, EAST END OF STAIRWAY
440	F-098	40103	IN ROOM 105. BY NORTHWEST EXIT. DOOR # 7.
442	F-092	41609	IN ROOM 101. BY NORTHWEST ENTRANCE. DOOR
444	F-103	40701	IN ROOM 125. WEST END OF HEAT TREAT FACILITY.

OMMENTS:	

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## ROCKY FLATS FIRE DEPARTMENT SEMIANNUAL HALON SUPPRESSION SERVICING AND TESTING

					1	GROUF'-1	ב
INSPECTE	ED AND TEST						
SAIFT AS	SSIGNED:			M	ONTH OF:		
HAVE ALL	. ALARMS BE	EN LOGGED:	YES NO				
BUILDING	9: 130	DEVICE NUM	BER: FHA-010	ALARM	NUMBER:	Reports Headqua	
LOCATION	OF CYLING	DER: 2nd flo	por in room	219, Southe	ast corr	ner	
LOCATION	OF ALARM	PANEL: 2nd	floor in ro	om 220. on	West wal	11.	
TYPE	CYLINDERS	DATE	MAIN OR RESERVE	READING	Ļ	CHECKED I WEIGHT OF LIQUID LE	EVEL
	148 LBS.		MAIN				

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## ROCKY FLATS FIRE DEPARTMENT FIRE PREVENTION INSPECTION AND TEST RECORD [SECTION 1A]

		QUAF	RT.	ERLY AUT	OMATIC	FIRE A	<b></b> -	ARM T	E	STING				
BUILDIN NUMBER	1	DEVICE NUMBER	:	NUMBER	IAND NO	RMAL	ł	CO						
		FSD-007			:	!	;	N/A	;	N/A:	N/A:	N/A	;	
T112A	;	FSD-021	;	42307		;	;	N/A	;	N/A!	N/A1	N/A	1	
121	;	FHA-005	;	42613	;	:	+	N/A	!	N/A1	N/A1	N/A	:	
125	;	FSD-058	;	42612	;	;	;	N/A	:	N/A!	N/A:	N/A	;	
127	- <b>-</b> -	FCD-005	}	42611	1	1	;		;	:	N/A1	N/A	;	
130	:	FHA-010	:	43510	!	:	;	N/A	:	N/A!	:		;	
251		FHA-003	;			;	;	N/A	:	N/A:	;		;	* ** ** **
331	;	FSD-009	;	41901	!	;	:	N/A	:	N/A:	N/A!	N/A	·	
T334B	:	FSD-045	;	41905	!	!		N/A	:	N/A:	N/A:	N/A	:	

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### ROCKY FLATS FIRE DEPARTMENT QUARTERLY BUILDING FILTER PLENUM TESTING [SECTION 14]

[GROUP1]

SHIFT ASSIGNED:	MONTH OF:
HAVE ALL ALARMS BEEN LOG	GED: YES NO
ILDING: 371 DEVICE NO:	FFF-001 DELTA NO.10101
LTE PLENUMS INVOLVED: FF	-121A&B, FF-122, FP-142, FP-141, FP-243,
FILTER	PLENUM CONTROL VALVES
	DURING TEST: AFTER TEST
CONTROL VALVE : CLOSEI	: VALVE : OPEN AND : OPEN AND : TRIPPED : CONTROL VALVE : LOCKED : O : YES : NO : NUMBERS : YES : NO
P-121A 371B-14!	: : : : : : : : : : : : : : : : : : :
P-121B 371B-11! :	:
P-122 371B-17!	!
F-142 3718-20: :	
P-142 371B-21: :	
P-141 371B-24: :	
FP-141 371B-25:	
P-243 3718-28; ;	
E-243 3718-29! !	

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## ROCKY FLATS FIRE DEPARTMENT [GROUP-1] QUARTERLY FLANT WATER CONTROL VALVE INSPECTION (SECTION 1A)

INSFECTED AND TESTED BY:																						
SHIFT	AS:	SIGNED:	_	MONTH OF:																		
VALVE NUMBER	:	FOSITION OPEN : CLOSED	<i>:</i>	LOCKE YES !	ED N	0	; ;	F	100	YTF S	; OL	S DF	;	TYPE FVI	: '	VAI G	LVE .V.	V#	ALVE R	: :	PENS L	:
B3-1R	;	!	:		X		 :	X	;		;		:		1		x	;	x	;		:
83-2G	;	;	<u> </u>	;			    -		;	X	;		;	X	;			:	X	:		:
B3-3R	:	1	;	;			 	х	:		:		:	Х	:			:	X	;		:
B3-4G	1	:	:	:			:		;	X	1		;	X	;			!	X	;		:
		ŀ																			·	
B3-7R		;	;		X		 !	X	;		;		;		1		x	:	X	:		:
83-6R	:	1					 	X	:		;		;	X	;			:	Х	:		:
	:	;	:	;			:		;		:		!		-			:		:		:
	:	:	:	!			: 		: 		!		!		:			:		!		!
84-1G		!	:	:			: 		:	X	:		;	X	¦ 			:	X	¦ 		• •
B4-2G	<b>:</b>	:	:	:			! 		:	X	: 		:	X	; 			:	X	; 		:
84-3G	:	!	:	:			:		:	X	:		; 	X	  -			:	X	:		
84-4R	:		:	:	X		: 	X	!		:		:		:	,	( 	: 		;	X :	:
B4-6R	:	;	:	:			:	X	;		¦		  -	X	;			:	X	:	; ; ;	:
64-7R	:	:	:	:	X		: 	X	:		:		:		:	,	( 	:		:		
64-8G	;	1	:	:			: 		:	X	:		:	X	:			:	X	:	!	
64-9R	:	!	:		X		:	X	:		:		 :		:	×		:	X			:
	:	; ;	:	:			:		:		:		:		;			: 			·:	:
	:	!	:	;			:		:		: 		:		: 			;			·	
B5-2R		!	;	:			: 	x	:		;		;	×	:			:			x :	
85-3R	:	:	:	:	x		·	X	:		 : 		; 		·	X			x :		; ;	
85-6R	;	:	  -	;	X		:	X	1		:		: :		: -	X		_	x ;		′	
																					;	

Date: October 3, 1983 Revision No.: 1
Appendix F-3

#### ROCKY FLATS FIRE DEPARTMENT ANNUAL BUILDING FIRE PROTECTION TESTING SMOKE DETECTION

CGROUP-

BUILDIN	۱G:	112	DEVICE	NUMBER	: FSI	0-007	Al	_ARM	DELT	4 FO	INT:	42305
SHIFT ASSIGNED: MONTH OF AUGUST												
INSPECTED AND TESTED BY:												
HAVE ALARMS BEEN LOGGED: YES NQ												
ALARM PANEL LOCATION: IN ROOM 111, BY EAST ENTRANCE TO CAFETERIA DOCK.												
			TYPE DETECTOR	:SVA-A	LARM	:FULL	ALARI	1: SE	ENSI	LIVI.	TY SE	
00004	:	1.0	CPD-7021	1	;	;	;	:	;	;	;	1
00008	;	1.0	CFD-7021	;	;	:	1	1	:	;	;	1
00009	;	1.0	:CPD-8021	;	;	:	;	:	:	1	:	;
00010	;	1.0	CPD-7021	;	;	:	!	:	;	;	;	!
00007	;	1.0	CPD-7021	!	1	:	;	:	;	;	;	!
00006	;	1.0	CPD-7021	:	;	:	;	!	:	:	:	;
00005	;	1.0	CPD-7021	!	!	;	;	;	:	:	:	;
00001	;	1.0	CFD-7021	!	:	:	:	:	;	:	: :	:
00002	;	1.0	CPD-7021	;	:	:	;	:	;	;	:	;
00003	;	1.0	CPD-7021	; ;	;	:	:	:	:	:	;	;
COMMENTS:												

DATE REVISED: AUGUST 13,1986

Date: October 3, 1988 Revision No.: 1

Appendix F-3

## ROCKY FLATS FIRE DEFARTMENT ANNUAL BUILDING COOLING TOWER TEST DATA

[GROUP-1]

INSPECTED AND TESTED BY:							
SHIFT ASSIGNED:	_	MONTH OF	SEPTEMBER 1	986			
BUILDING: 373 DEVICE NUMBER:	K-003	DELTA NUM	BER: 12418				
MANUFACTURE: GRINNELL		RISER SIZ	E: 8 INCH				
			·				
WATER SUPPLY PRESSURE:				LBS.			
PNEUMATIC LINE FRESSURE:				LBS.			
HOUSE AIR SUPPLY PRESSURE:				LBS.			
NITROGEN SUPPLY PRESSURE:				LBS.			
NITROGEN CYLINDER PRESSURE:			=======	LBS.			
TRIP POINT-AIR/NITROGEN PRESSURE:				LBS.			
TRIP POINT-WATER PRESSURE:				LBS.			
TIME OF TRIP AFTER INSPECTORS TEST	IS OPENED	:	MIN S	EC			
TIME OF WATER FLOW AFTER INSPECTOR	S TEST IS (	OPENED:	MIN S	EC			
TIME FROM INSPECTORS TEST OPENING ON:	TILL FIRE F	FUMPS COME	MIN S	EC			
ALARM OPERATIONS - USING INSPECTOR	S TEST VAL	VE:					
LOW AIR TROUBLE ALARM:	YES 1	NO AT	L	BS.			
LOCAL ALARM:	YES 1	NO					
COOLING TOWER FAN(S) SHUT DOWN:	YE5 1	NO					
FULL ALARM TO FIRE DEPARTMENT:	YES N	NO					
MANUAL FULL OFERATED FROFERLY:	YES N	NO					
TIME OF WATER FLOW AFTER MANUAL FULL IS OPERATED: MIN SEC							
TRIF FOINT-WATER PRESSURE:	LBS.						

Date: October 3, 1988 Revision No.: 1

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BUILDING 373 COOLING TOWER TEST (CONT.)										
ALARM OPERATIONS - USING MANUAL FULL STATION:										
OCAL ALARM:	YES NO									
COOLING TOWER FAN(S) SHUT DOWN:	YES NO									
FULL ALARM TO FIRE DEPARTMENT:	YES NO									
COMMENTS: (CLOGGED HEADS, BROKEN		•								

DATE ISSUED: AUGUST 10,1764

Date: October 3, 1988 Revision No.: 1

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## ROCKY FLATS FIRE DEPARTMENT ANNUAL BUILDING HOSEREEL TESTING [GROUF-1]

INSPECTED AND TESTED BY:							
SHIFT AS	SHIFT ASSIGNED: MONTH OF: JULY						
					YES: NO:		
HAS BUIL	DING HOSER	EE	_ TEST (	CAI	RD BEEN LOGGED: YES: NO:		
	: CABINET			;	LOCATION		
3719-18	: REEL	!			TOP OF STAIRWAY # 1, INSIDE AIR INTAKE FILTER PLENUM.		
371 <b>C-5</b>	REEL	;	2-50*	;	ATTIC AREA ROOM 4001. BY STAIRWAY # 1.		
3710-6	: REEL	;	2-50'		ATTIC AREA ROOM 4004, SOUTH SIDE OF BUILD-ING BY STAIRWAY # 3.		
3710-7	: REEL	i	2-50'		ATTIC AREA, EAST END OF BUILDING IN ROOM 4303.		
371C-8	: REEL	:	2-50'		ATTIC AREA. EAST END OF BUILDING IN AIR- LOCK ROOM 4003.		
3718-7	REEL	:	2-50'		ATTIC AREA, NORTH SIDE OF BUILDING IN STAIRWAY # 2		
371A-1	CABINET	;	2-50'	;	1ST FLOOR. HALLWAY 3025, BY STAIRWAY #7.		
371A-2	: CABINET	:	2-50'	;	1ST FLOOR. HALLWAY 3018. BY CAFETERIA.		
371A-3	: CABINET	:	2-50'		1ST FLOOR, HALLWAY 3002. BY MENS LOCKER ROOM.		
371A-4	: CABINET	;	2-50%	;	1ST FLOOR INSIDE MENS LOCKER ROOM 3141.		
371A- <b>5</b>	: CABINET	;	2-501		1ST FLOOR, HALLWAY 3008. WEST END OF BUILD ING IN OFFICE AREA.		
37 <b>18-1</b>	: REEL	;	2-50'	;	1ST FLOOR, HALLWAY 3042, NORTH END.		
3719-2	: REEL	;	2-501		1ST FLOOR. IN ROOM 3701 ON WEST WALL IN INCINERATOR AREA.		
371 <b>8-</b> 3	: REEL	:	2-50°		1ST FLOOR, HALLWAY 3543 ON SOUTH WALL NEAR COLUMN G-7.		
371B-4	REEL	;	2-50'		1ST FLOOR HALLWAY 3321, ON SOUTH WALL NEAR COLUMN G-2.		

Date: October 3, 1988

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## Emergency Shower and Eyewash

## Inspection Checklist

B1. <b>D3</b>	коом %0.	NO. of SHOWER	EYE		CKD BY:	DATE	COMMENTS
		-					
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	-						,
			- 1	·			
	<del>- i</del> -						
				-			

OTHER COMMENTS:

APPENDIX G-1
RESERVED

APPENDIX G-2
RESERVED

## APPENDIX H-1

## HAZARDOUS MATERIALS RESPONSE TEAM INITIAL TRAINING

## Internal Letter



Date - July 20, 1988

TO (Name, Organization, Internal Address)

· A. C. Ficklin

· Waste Operations

· Building 374

No.

FROM (Name, Organization, Internal Address, Phone)

· T. J. Parker

· Fire Department

· Building 331F

. 4336

#### SUBJECT: HAZARDOUS MATERIALS RESPONSE TEAM INITIAL TRAINING

At present, the Fire Department has established a 3-Tiered Training Program for all HAZ-MAT Response personnel. Tier 1 is a 24-hour class that primarily deals with the awareness and identification of hazardous materials. In addition, each firefighter must pass a written examination with 80%. The following is a list of course objectives and description of topics covered.

#### **OBJECTIVES**

- Participants should have basic general knowledge of the various classes of hazardous materials.
- 2. participants can identify labels, placards and characteristics of containers used in handling hazardous materials.
- 3. Participants can identify appropriate first-response actions when presented with simulated hazardous materials accidents/incidents.
- 4. Participants will be aware of existing emergency resources and will be able to locate necessary information quickly and accurately.
- Participants will be aware of the need to develop pre-plans in their local communities.
- 6. Participants will be able to describe the functions of a command post as they relate to the necessity of effective communication and cooperation during emergencies.
- 7. Participants will seek additional knowledge and training for dealing with hazardous materials emergencies through extended seminars or further study in the field.

#### DESCRIPTION OF TOPICS

## 1. Introduction to Hazardous Materials

A video of hazardous materials incidents, followed by group discussion.

## 2. General Classes of Hazardous Materials, Labels and Placards

Presented in this time frame will be a discussion of the general background of hazardous materials. We will look at and discuss labels and placards, emphasizing their meaning and value.

#### 3. Rail Involvement

Information will be given pertaining to the safe handling of an accident/incident involving hazardous materials on the railroad system.

## 4. Cargo Tank

Cargo tank safety features and emergency action to take are emphasized in this time period.

### 5. Air Involvement

Precautions and procedures in reacting to aircraft emergencies are covered in this session.

#### 6. Incident Command

During this session, we will talk about the types of incident command, when they should be established and what and who should be involved.

## 7. Emergency Situations

How to control the scene, items to look for, as well as thoughts on pre-planning will be presented to the participants during this seminar session.

#### 8. Protective Equipment

Protective equipment for use in the safe handling of hazardous materials will be discussed and demonstrated.

#### 9. Compressed Gases/Flammable Liquid

Compressed gases and closed containers are discussed during this portion of the seminar.

## 10. Emergency Response

Ideas and suggestions of fire fighting involving hazardous materials are pointed out and discussed at this time.

## 11. Shipping Papers

How to make out proper shipping papers and what to look for to obtain needed information if an accident occurs will be presented during this instructional period.

#### 12. Radioactive Materials

How should you approach and safely handle an accident/incident involving radioactive materials? This period of instruction will answer this question and many others.

### 13. Resources Available for Assistance

Examples of agencies available for assistance and the type of services they offer are discussed this block of instruction.

## 14. Containment and Control

Dikes, booms and diversions are just some of the items spotlighted in this segment of time.

#### 15. First Response

A situation will be given to the participants which they will "solve" individually. Their responses will reflect the actions that someone would take who was the first person at the scene of an emergency involving possible hazardous materials.

#### 16. Simulated Hazardous Materials Incidents

Participants are divided into groups representing communities. Each "community" will be given a simulated accident/incident and they will respond as a community entity. Discussion of "community" actions will follow each situation. Emphasis will be placed on the use of a pre-plan procedure and demonstration of effective communication skills.

Tier 2 is an 80-hour program dedicated to the hands-on approach to hazardous materials. It provides the firefighter with the knowledge, skills and ability to respond to, and safety cope with incidents involving certain hazardous materials. In addition, each firefighter must pass a written examination with 80%. The following is a list of the course objectives and description of topics covered.

#### OBJECTIVES

- 1. Given a fact situation, determine how to use Title 49 Code of Federal Regulations Part 100-177.
- 2. Given a fact situation, identify personnel protective safety equipment to be used for a given incident.
- 3. Given a fact situation, identify the proper decontamination procedures to use for hazardous materials incidents.
- 4. Given a fact situation, identify safety methods to respond to and mitigate a chlorine incident.
- 5. Given a fact situation, determine the proper procedures for applying a chlorine kit.
- 6. Given a fact situation, identify safety methods to respond to and to mitigate an industrial chemical incident.
- 7. Given a fact situation, identify a cryogenic.
- 8. Given a fact situation, respond to a cryogenic incident.
- 9. Given a practical situation, respond to a cryogenic incident.
- 10. Given a fact situation, determine a safe response to a poison gas incident.
- 11. Given a fact situation, identify anhydrous ammonia.
- 12. Given a fact situation, determine what methods should be used to cope with an anhydrous ammonia incident.
- 13. Given a fact situation, identify an electrical hazard.
- 14. Given a fact situation, determine the proper methods used to cope with a pipeline incident.
- 15. Given a fact situation, determine the best response procedures to a pesticide incident.
- 16. Given a fact situation, identify the personnel protective equipment needed to respond to a pesticide incident.
- 17. Given a fact situation, identify the proper methods to cope with a liquefied petroleum gases.
- 18. Given a practical situation, respond to and handle a propane fire.
- 19. Given a fact situation, identify how acids and gases react during an incident.

- 20. Given a fact situation, identify response considerations to an incident involving explosives.
- Given a fact situation, determine what the term B.L.E.V.E. means.
- 22. Given a fact situation, identify proper response techniques to a rail tank car incident.
- 23. Given a fact situation, determine the safety features of a cargo tank.
- 24. Given a fact situation, identify the Incident Command Organization.
- 25. Given a fact situation, determine the structure of a plan.
- 26. Given a fact situation, determine the proper procedures to use during containment of hazardous materials incidents.
- 27. Given a fact situation, identify different items which may be used to control hazardous materials spills.
- 28. Given a fact situation, determine the proper procedures to respond to and cope with a hazardous materials incident being transported by aircraft.

#### DESCRIPTION OF TOPICS

#### 1. Poison Gases

The effects of poison gases on the first responder and methods to cope with poison gas incidents will be presented during this time period.

## 2. Anhydrous Ammonia

How emergency responders should respond to a anhydrous ammonia incident and how to safety cope with anhydrous ammonia spills will be presented.

## 3. Electric Hazards/Pipeline Distribution

Two areas of concern will be presented during this time period. First, what hazards first responders will face when confronted with electrical situations. Second, what hazards first responders will face when confronted with pipeline incidents and safe response procedures to both.

## 4. Pesticides

How to detect a pesticide hazard and how to utilize the information obtained from various sources when responding to an incident will be discussed.

## 5. Resources Available

Examples of agencies available for assistance, written resources and what they can do for the incident response persons will be presented during this course of instruction.

## 6. Liquefied Petroleum Gas

Compressed gases and closed containers are discussed and hands-on "How To" will be presented during this time period.

### 7. Acids and Bases

Characteristics of acids and bases and how they may react during a spill and safe response to those spills will be presented.

## 8. Explosives

What are they, where the responder may come into contact with them, and how to safely deal with them will be discussed during this time period.

### 9. Radioactive Materials

During this time period we will discuss radioactive materials, response methods and pitfalls to watch out for during emergency situations.

## 10. Hazardous Materials by Rail

Safety response, methods of obtaining vital information and incident mitigation procedures are presented during this course of instruction.

#### 11. Hazardous Materials by Cargo Tank

Cargo tank safety features and emergency actions to take are emphasized in this time period.

## 12. Pre-Planning/Incident Command

Two sections of instruction will be presented. First, pre-plan what is it? Who is involved? How to construct a plan and why one is needed. Second, what is incident command? How does it work and why is it needed?

## 13. Containment and Control of Hazardous Materials

Plugging, patching, dikes, booms and diversions are just some of the areas covered during this segment of instruction.

## 14. Hazardous Materials by Air

Safe response procedures and hazards of response to aircraft incidents are presented during this time period.

Tier 3 comprises 24-hours of annual HAZ-MAT Response Training. This training covers:

- 1. Incidents, response and mitigation.
- 2. Decontamination
- Equipment use and maintenance and four (4) standard operating procedures as well as many of the topics listed above.

As I understand the OSHA/SARA and NFPA requirements for HAZ-MAT Response Training, we will more than exceed the minimum requirements. Time lines for completion of Tier 2 Training is scheduled for December 1990.

T. J. Parker, Captain

Training Division

Fire Department

## APPENDIX H-2 RCRA TRAINING COURSE MATERIAL

#### RCRA HAZARDOUS WASTE TRAINING PROGRAM SUMMARY COURSE NO. 23-435

#### Introduction

Our nation's industries have generated vast quantities of wastes over the years. The Environmental Protection Agency (EPA) estimates that this country produces approximately 60 million tons of hazardous waste annually.

With the passage of the Solid Waste Disposal Act in 1965, we began to address the problems associated with waste generation. The Act helped local governments turn their open dumps into covered sanitary landfills. The covered landfills reduced air pollution and odors emanating from the dumps/landfills.

In 1976, congress enacted the Resource Conservation and Recovery Act (RCRA) which called for control of all hazardous wastes generated in this country. On May 19, 1980, the EPA, in response to its congressional mandate to implement the Act, promulgated hazardous waste regulations. RCRA established a "cradle-to-grave" management system to track hazardous wastes from the point of generation to final disposal.

In 1984, Congress passed additional legislation referred to as the 1984 RCRA Amendments. The RCRA Amendments impose a variety of new, more stringent requirements on hazardous waste generators, transporters, and the owners/operators of treatment, storage and disposal facilities within the regulated community. Significant provisions include: bans on land disposal of certain wastes; restrictions on placement of liquid wastes in landfills; and establishment of minimum technological requirements for landfills and surface impoundments.

## Who is involved?

The RCRA regulations specify the three main participants in the hazardous waste system as the generator, the transporter and the owner or operator of the treatment, storage, and disposal facility (TSDF). The generator determines at what point a substance is declared a waste, if it is hazardous and ensures that it is disposed of in a safe and secure manner. The transporter moves the hazardous waste from the generation site to the TSDF. The TSDF is the site where the waste is treated, stored, or disposed of, whether that is accomplished by landfilling, incineration, chemical treatment, or other means.

### Liability

Under the current regulations, all generators are responsible for the safe "cradle-to-grave" management of any hazardous waste that they generate. This responsibility includes verifying that hazardous waste materials are packaged, stored, transported and disposed of in full compliance with RCRA and Department of Transportation (DOT) regulations. Generators of hazardous wastes are held responsible for damage caused to the environment or personal property by their wastes, even if attempts are made to dispose of the materials properly. Therefore, because there is no statute of limitation, the generator should retain, for an indefinite time, all appropriate documentation of on-site treatment, storage, and disposal of the waste or of its delivery to a permitted off-site TSDF.

### What is a Hazardous Waste

Simply defined, a hazardous waste is a "solid waste" that exhibits toxic or hazardous characteristics as outlined in Subpart C of the Code of Federal Regulations. A solid waste, by EPA definition, can be any of the following:

- o Garbage, refuse or sludge; or
- Any solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining or agricultural operations, or from community activity that is:
  - a. Being "disposed of" by discharging, depositing, injecting, dumping, spilling, leaking, or placing into land or water so that any constituent of the waste may enter the environment; or
  - b. A manufacturing or mining by-product.

#### Hazardous Waste Determination

There are two approaches in determining whether or not a waste is hazardous.

- 1. Hazardous waste lists compiled by EPA
- Waste exhibits one or more of the following characteristics.
  - o IGNITABILITY
  - o CORROSIVITY
  - o REACTIVITY
  - o EXTRACTION PROCEDURE (EP) TOXICITY

## Excluded Wastes

Certain categories of wastes are not subject to RCRA hazardous waste controls. Included are:

- Waste water discharges regulated under the Clean Water Act, e.g., industrial effluents
- Source or special nuclear material regulated under the Atomic Energy Act
- Irrigation return flows
- o Coal Combustion wastes
- o Oil, gas, and geothermal drilling muds and brines\*
- o Mining wastes, as from extraction, beneficiation and processing of ores and minerals\*
- o Cement kiln dust\*
- \* These categories are temporally excluded pending completion of on-going studies.

#### Generator's Responsibilities

Each generator of regulated solid wastes must fulfill the following obligations under RCRA:

- o Determine whether the waste is hazardous
- Notify EPA and appropriate state agencies of activities involving hazardous wastes
- o Keep accurate records of all hazardous waste activities and provide required reports
- Store all hazardous wastes in accordance with RCRA requirements
- Prepare all wastes for transport to the disposal facility
- Comply will all state handling, storing, permitting, record-keeping, reporting and transporting requirements.

#### RCRA Permit

Most facilities that treat, store, or dispose of hazardous waste must obtain a RCRA permit. The application for this permit consists of two parts: Part A and Part B. Certain facilities have been required to submit Part A (those in existence before November 19, 1980). Those facilities have been granted "interim status", which allows them to continue to operate until final administrative action is taken on their permit. To obtain a RCRA permit, however, these facilities must submit Part B applications. The EPA Regional Administrators have the authority to request owners and operators of existing hazardous waste

management (HWM) storage and treatment facilities to submit Part B of their RCRA permit application.

An applicant for a RCRA permit should be aware that the EPA and the states share responsibilities for the administration of the RCRA permit program. Each state's role can vary according to the status of its authorization to administer the hazardous waste permit program.

The Rocky Flats Plant is required under RCRA and the State of Colorado RCRA-equivalent program to obtain permits for its hazardous waste treatment, storage, and disposal facilities. It also has to comply with regulations concerning generation, handling, and transport of hazardous wastes. Based on Compliance Orders between the Department of Energy (DOE), the EPA, and the State of Colorado, mixed hazardous and radioactive wastes must also be managed in accordance with RCRA requirements. These requirements directly impact every individual associated with any aspect of hazardous waste management at the Rocky Flats Plant.

This introductory training program is designed to inform all Rocky Flats personnel of the basic requirements of the RCRA program. It is only a small part of the overall hazardous waste training that you will receive at the Plant, to be supplemented by detailed on-the-job training, as well as periodic refresher training.

### Hazardous Waste Management Program

As a facility that generated, transports, treats and stores hazardous wastes, Rocky Flats is subject to most of the requirements of RCRA. Although it no longer operates a disposal facility, the Plant has land disposal facilities that will have to be managed, closed, and remediated in accordance4 with the regulations. The law also requires that the Rocky Flats waste management program directors institute personnel training programs, facility inspections, contingency plans, waste identification and analysis programs, and record-keeping systems. Because of the nature of the programs that are conducted at Rocky Flats, most of the required security issues are currently satisfied.

The primary objective of this training program is to provide an understanding of the policies and procedures necessary to protect human health and the environment and to ensure personal safety. Virtually all RCRA requirements were instituted to force industry to achieve these goals. The detailed RCRA on-the-job training program, combined with the basic Rocky Flats core training program, should enable each employee to be sufficiently prepared to meet the challenges of must unexpected events which could result in hazardous situations. In general, you will be trained to recognize conditions that may lead to potential hazards and what to do in response to an accident or situation involving a hazardous release. You will also be instructed in proper

hazardous waste management practices and will be expected to recognize those practices which are unacceptable by today's standards.

You should be aware that civil and criminal charges can be levied in cases where disregard of standards and required practices is evident. Rather than act unknowingly, you will be expected to contact Waste Operations to receive guidance on specific actions or practices related to hazardous waste management. Personnel should be available at extension 4885 to answer any specific questions you might have. The Waste Operations Department is ultimately responsible for determining the fate of any hazardous wastes generated in your area. However, you may be responsible for originating a standard Waste Processing Request Form (WPRF) to assist Waste Operations in this determination. A copy of the standard Rocky Flats WPRF is attached to this summary.

Although you probably will not be responsible for conducting any of the tests necessary to evaluate a waste for hazardous characteristics, you should at least be aware of the methods used to make this determination to give you a basic understanding of what constitutes a hazard. There are two primary means of determining whether or not a waste is hazardous. The first method is fairly simple: if a waste is listed in the EPA's hazardous waste regulations, then it is automatically a hazardous waste. This list is available from Waste Operations at your request. The second method for evaluating wastes is somewhat

more detailed. If a waste exhibits any one of four hazardous characteristics, it is considered a hazardous waste. These characteristics include ignitability (flashpoint less than  $140^{\circ}$ F); corrosivity (pH less than or equal to 2 or greater than or equal to 12.5); reactivity (yielding heat or toxic gases); and Extraction Procedure Toxicity (potential for leaching heavy metals and toxic organics). All hazardous wastes present at Rocky Flats are identified by the characteristics that cause them to be hazardous.

Part of your work responsibilities may include periodic inspection of hazardous waste management facilities. Inspections are required under RCRA to ensure proper facility operations, to prevent equipment failure, to identify unsatisfactory and dangerous conditions, and to inventory emergency supplies. Inspections for each type of management facility (such as drum storage, tank storage, incineration, or treatment) are detailed in the hazardous waste regulations or other EPA publications. Typical inspection items include checking the condition of containers, looking for leaks or spills, and checking standard operating conditions. Inspections must be performed on a regular, periodic basis, typically daily, weekly, monthly, or semi-annually.

Records of all inspections must be maintained at the Rocky Flats facility. In addition to inspection logs, records documenting training programs, waste analyses, and waste tracking procedures

(WPRF and manifest) must also be maintained. The importance of your input to this process cannot be emphasized enough. It may be your responsibility to conduct inspections or supply the necessary documentation. Therefore, your efforts can ultimately result in the success (or failure) of the hazardous waste management system.

Finally, you should already be somewhat familiar with Rocky Flats emergency response plans that have been developed in accordance with other regulations and DOE requirements. RCRA also requires that a Contingency Plan be prepared for the facility that can be implemented in the event of a sudden release of hazardous wastes that could threaten human health or the environment. Most leaks and spills will probably be able to be contained near their occurrence and will not require implementation of the Contingency Plan. However, it will be your responsibility to contact the building supervisor or the Emergency Director (extension 2911) in the event of any hazardous waste spill. If a spill is sufficient to cause implementation of the Contingency Plan, the plan will identify the human resources necessary to deal with the emergency situation. You will be required to review the elements of the Contingency Plan during your on-the-job training.

Remember, if you are unsure of any aspects of the hazardous waste management procedures at Rocky Flats, contact your supervisor or Waste Operations. The success of our hazardous waste management program depends on you.

#### APPENDIX I-1

## EXPOSURE INFORMATION REPORT

ORIGINAL PROCESS WASTE LINES SOLAR EVAPORATION PONDS PRESENT LANDFILL WEST SPRAY FIELD

5 October 1988

Prepared by:

Roy F. Weston, Inc. 215 Union Boulevard Suite 600 Lakewood, Colorado 80228

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#### SECTION 1.0

#### INTRODUCTION

This Exposure Information Report (EIR) addresses three separate waste management units at the Rocky Flats Plant. The subject units are the solar ponds, the present landfill and the West Spray Field.

The EIR has been prepared in accordance with the guidance document, <u>Permit Applicants' Guidance Manual for Exposure Information Requirements Under RCRA Section 3019</u> (U.S. EPA, July 3, 1985). For ease of review, the organization of the EIR follows that given in the <u>Guidance Manual</u>.

The EIR is being submitted as an appendix to the RCRA Part B Post-Closure Care Permit Application-Interim Status Facilities. It is intended that the EIR be reviewed in conjunction with this document and with the RCRA Part B Permit Application. References are made in the EIR to pertinent information that is located in these two Applications.

At the writing of this report, the present landfill is in full operation, with plans being made for its closure; the solar ponds are undergoing closure; the West Spray Field is no longer in operation. The EIR addresses the exposure potential of the present landfill when active, the west spray field after cessation of operations, and the solar evaporation ponds when active, during closure, and after closure. The Original Process Waste Lines (OPWL) will be addressed in the EIR if necessary. They are not addressed in this revision since the need for post-closure care of the OPWL has not yet been determined. The need for post-closure care at the Landfill, West Spray Field, and Solar Ponds have already been determined.

There are five solar evaporation ponds at the Rocky Flats Plant: Pond 207-A, Ponds 207-B North, South, and Center, and Pond 207-C. Pond 207-A began operation in 1956; Ponds 207-B (North, South, Center), in 1960; and Pond 207-C, in 1970. The ponds were constructed to store and treat (by evaporation) low level radioactive process wastes containing high nitrates and treated acidic wastes containing aluminum hydroxide. Other wastes have been received during their years of operation (see Section 2.1.4). At the present time, Ponds 207-A and 207-C are used only on an emergency basis and Pond 207-B North is the only pond and is used to store intercepted seepage water from the solar ponds. Ponds 207-

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B Center and South are also used for intercepted seepage water. A history of the solar ponds is contained in Appendix I-2 (Closure Plan - Solar Evaporation Ponds, "Description of the 207 Solar Evaporation Ponds") of the Post-Closure Care Application.

The present landfill began operation in 1968. Operations at the landfill have changed during its years of service in accordance with changes in regulatory statutes. The changes that have occurred in disposal policies at the present landfill, including material acceptability, are discussed in Appendix I-3 of the Post-Closure Care Permit Application, (Closure Plan - Present Landfill, "Disposal Policies").

The West Spray Field was operated as a land treatment facility from 1982 to 1985. During its years of operation, aqueous wastes from Solar Evaporation Ponds 207-B North and Center were spray irrigated onto the field when the storage capacity of the pond(s) was reached. The West Spray Field covers approximately 105.1 acres, of which approximately 38.8 acres received direct application. A detailed description of the facility and of the past application operations may be found in Appendix I-4 (Closure Plan — West Spray Field, "Description of the West Spray Field") in the Post-Closure Care Permit Application.

#### SECTION 2.0

#### INFORMATION REQUIREMENTS

## 2.1 <u>GENERAL INFORMATION</u>

In accordance with Resource Conservation and Recovery Act (RCRA) Section 3019(a), reasonably ascertainable information regarding the potential for the public to be exposed to hazardous wastes or hazardous constituents through releases related to the unit must be provided. This Exposure Information Report (EIR) must accompany each application for final determination, and at a minimum the information must address:

- "(1) reasonably foreseeable potential releases from both normal operations and accidents at the unit, including releases associated with transportation to or from the unit;
- (2) the potential pathways of human exposure to hazardous wastes or constituents resulting from the releases described under paragraph (1); and
- (3) the potential magnitude and nature of the human exposure resulting from such releases."

## 2.1.1 <u>Health and Risk Assessment Information and Reports</u>

There are no existing health or risk assessments that relate specifically to the present landfill or the West Spray Field. health assessment relating to prior usage of the solar evaporation ponds is contained in the Final Environmental Impact Statement (FEIS), Rocky Flats Plant Site (DOE, 1980). The FEIS health evaluation considers the radiation health hazards that might be posed if past radioactive contents of the solar evaporation ponds were to be released through an impoundment failure. pond assessment is a subpart of Section 3 of the FEIS which considers the potential consequences of a number of possible Plantrelated accidents. The portions of the report which relate to the solar evaporation ponds (i.e., impoundment failure) are reproduced in Attachment 1. It is important to note that the FEIS assessment evaluates the potential risks posed by the solar ponds only while receiving radioactive wastes. The evaluation is not applicable to current usage nor to the unit after closure.

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#### 2.1.2 Zoning and Land Use Maps

A composite land-use planning map which was developed from regional land-use plans and zoning maps may be found in Section B of the Post-Closure Care Permit Application (Facility Description, "Land Uses").

#### 2.1.3 Existing Aerial Photographs

An aerial photograph showing the three subject units (solar evaporation ponds, West Spray Field, present landfill) is found in Attachment 2.

#### 2.1.4 Additional Waste Analysis Data

During their years of operation, the solar evaporation ponds received primarily low level radioactive process wastes containing elevated concentrations of nitrates, and treated acid wastes containing aluminum hydroxide. They have also received other wastes, including sanitary sewage sludge, lithium metal, sodium nitrate, ferric chloride, lithium chloride, sulfuric acid, ammonium persulfate, hydrochloric acid, nitric acid, hexavalent chrome, and cyanide solutions. Solvents may also have been present as a minor part of aqueous wastes, but were not routinely disposed of in the ponds. Ponds 207-B Center and South have received tertiary treated sanitary effluent and product water from the Reverse Osmosis Plant (see Appendix I-2, Closure Plan -Solar Evaporation Ponds, "Past Use"). Summaries of data (April-May 1986) characterizing the substances contained in Solar Ponds 207-A and 207-B North are presented in Tables 2-1, 2-2, and 2-3. The data shown in these tables are considered indicative of the content of the ponds at that time. A complete set of the data on which these tables are based can be found in Appendix I-4 (Closure Plan - West Spray Field, "Laboratory Test Results") of the Post-Closure Care Permit Application. Earlier data regarding the chemical composition of solar pond wastes can also be found in Appendix 6 of Appendix I-2. Liquid and/or sediment samples were collected from the five solar ponds in August 1986 for analysis of inorganic and organic parameters. The results of these analyses are also presented in Appendix 4 of Appendix I-4.

Disposal practices during its years of operation are briefly described in Appendix I-3 (Closure Plan - Present Landfill, "Disposal Policies") of the Post-Closure Care Permit Application. In general, the burial of solid and liquid wastes has been controlled in the past and maximum contaminant concentration limits have been set for radioactivity. The present management policy concerning material acceptability for burial requires no liquids,

TABLE 2-1

## CONCENTRATION RANGES OF RADIOACTIVE PARAMETERS IN SOLAR POND SAMPLES + COUNTING ERROR (APRIL-MAY 1986)

	Pond 207-A Liquid (pCi/l, total)	Pond 207-A Liquid (pCi/l, dissolved)	Pond 207-A Sediment (pCi/g, dry weight)	Pond 207-B North Liquid (pCi/l, dissolved)
Gross Alpha	32 <u>+</u> 38-80,000 <u>+</u> 6,000	46,000 <u>+</u> 4,000	4,700±200 <del>-</del> 14,000±1,000	16+41-120+50
Gross Beta	-2 <u>+</u> 83-40,000 <u>+</u> 2,000	37,000 <u>+</u> 2,000	160±20-1,400±	-21 <u>+</u> 84-100 <u>+</u> 92
Plutonium- 239	2.9±6.3-660 ±50	84 <u>+</u> 16	1,000±100- 3,700±100	-0.03+0.06- 0.05+0.07
Americium- 241	0.2 <u>+</u> 5.3-45 <u>+</u> 14	-2.2 <u>+</u> 3.6	1,400+200- 4,000 <u>+</u> 100	-0.02 <u>+</u> 0.04- 0.08 <u>+</u> 0.22
U-233 + U-234	-2 <u>+23-20,000+</u> 1,000	17,000 <u>+</u> 1,000	71 <u>+</u> 10-570 <u>+</u> 30	0.10 <u>+</u> 0.24- 53 <u>+</u> 2
U-238	4 <u>+</u> 19-21,000 <u>+</u> 1,000	22,000 <u>+</u> 1,000	130 <u>+</u> 10-480+ 30	-0.10±0.21- 33±1
Tritium	240 <u>+</u> 180-930 <u>+</u> 260	מא	1,300 <u>+</u> 500- 12,000 <u>+</u> 1,000	-40 <u>+</u> 260- 1,300 <u>+</u> 300
Air Dry Loss &	NA	NA	58.8-78.3	NA

NA = Not applicable
ND = No data available

Note: Some analytical values are reported as negative numbers. These negatives result when the measured value for the laboratory reagent blank is subtracted from a smaller measured analytical value.

#### TABLE 2-2

## CONCENTRATION RANGES OF INORGANICS AND PHENOLS IN SOLAR POND SAMPLES (APRIL-MAY 1986)

Aluminum Antimony Arsenic Barium Beryllium Cadmium Calcium Chromium Cobalt Copper Iron Lead Magnesium Manganese Mercury Nickel Potassium Selenium Silver Sodium Thallium Tin Vanadium Zinc	Pond 207-A Liquid (ug/l) 2,310-2,640 600U 150 200U 27-43 70-150 770-990 13,700-16,300 200-500 1,610-1,750 1,500-8,000 50U 1,540-1,650 95-115 0.2 1,900-2,000 13,200,000- 14,300,000 50U 310-370 36,300,000- 42,900,000 100U 7,000-13,000 100-210 620-780	Pond 207-A Sediment (mg/kg dry wt) 11,000-11,900 250U-333U 42U-56U 833U-1,110U 309-1,570 1,110-10,500 19,600-50,000 1,010-19,700 83U-111U 425-1,590 3,590-6,900 65-455 20,400-21,000 153-595 7.5-25 124-1,320 50,000-65,300  21U-28U 153-237 130,000- 166,000 42U-56U 167U-222U 208U-278U 227-595	Pond 207-B North Liquid (ug/1) 200U 60U 10U 200U-220 5U 5U 990-198,000 5U-9 20U 5U-14 20U-90 5U 407-72,600 5U-15 0.2U 20U-50 110-62,700 5U-9 5U-7 330-451,000
Phenols	13-35	1.70-3.3	3-46

U = Compound was analyzed for but not detected above the EPA protocol minimum detection (quantitation) limit. The number associated with the letter U is the minimum attainable detection limit (EPA Method No. 3050 (SW846); EPA 200 Series; HSL Base/Neutral and Acid Extractable Semi-Volatiles, EPA 625). Detection limits may vary between samples. In cases in which a substance was not found in any of the samples and in which the detection limit varied, the result is expressed as the range of detection limits for those samples, e.g., 83U-111U; in cases in which the detection limit was the same for all samples, the result is expressed as the common detection limit, e.g., 20U.

TABLE 2-3

#### CONCENTRATION RANGES OF VOLATILE ORGANIC COMPOUNDS IN SOLAR POND SAMPLES (APRIL-MAY 1986)

	Pond 207-A Liquid (uq/l)	Pond 207-A Sediment (ug/kg)	Pond 207-B North Liquid(ug/1)
Chloromethane	1000-10000	36U-4000U	100
Bromomethane	1000-10000	36U-4000U	100
Vinyl Chloride	1000-10000	36U-4000U	100
Chloroethane	1000-10000	36U-4000U	100
Methylene Chloride	50U-500U	180-20000	19B-71B
Acetone	1007-2607	5JB-4680	100
Carbon Disulfide	50U-500U	18U-200U	5U
1,1-Dichloroethene	50U-500U	180-20000	5 <b>U</b>
1,1-Dichloroethane	50U-500U	18U-2000U	ST
Trans-1,2-Dichloroethene	50U-500U	180-20000	50
Chloroform	50U-500U	180-20000	5 <b>U</b>
1,2-Dichloroethane	50U-500U	180-20000	5 <b>U</b>
2-Butanone	1000-10000	36U-4000U	100-20
1,1,1-Trichloroethane	50U-500U	180-20000	รับ
Carbon Tetrachloride	50U-500U	180-20000	5 <b>U</b>
Vinyl Acetate	1000-10000	36U-4000U	100
Bromodichloromethane	50U-500U	180-20000	5 <b>U</b>
1,2-Dichloropropane	500-5000	180-20000	5 <b>T</b>
Trans-1,3-Dichloropropene	50U-500U	180-20000	<b>5</b> 0
Trichloroethene	50U-500U	18U-2000U	50
Dibromochloromethane	50U-500U	18U-2000U	50
1,1,2-Trichloroethane	50U-500U	180-20000	50
Benzene	50U-500U	180-20000	50
cis-1,3-Dichloropropene	50U-500U	180-20000	5 <b>U</b>
2-Chloroethylvinylether	1000-10000	36U-4000U	100
Bronoform	50U-500U	18U-2000U	5U
4-Methyl-2-Pentanone	1000-10000	36U-4000U	100
2-Hexanone	1000-10000	36U-4000U	10U
Tetrachloroethene	1000-10000	200B-1800U	5U
1,1,2,2-Tetrachloroethane		18U-2000U	5U
Toluene	50U-500U	180-20000	5 <b>U</b>
Chlorobenzene	50U-500U	180-20000	<b>5</b> U
Ethylbenzene	500-5000	180-20000	<b>5</b> 0
Styrene	50U-500U	180-20000	5 <b>U</b>
Total Xylenes	50U-500U	180-20000	50

U = Compound was analyzed for but not detected above the EPA minimum detection (quantitation) limit (EPA CLP 7/85; HSL Volatile Organics Method, EPA 624). The number associated with the letter U is the minimum attainable detection limit. Detection limits may vary between samples. In cases in which a substance was not found in any of the samples and in which the detection limit varied, the result is expressed as the range of detection limits for those samples, e.g., 100U-1,000U; in cases in which the detection limit was the same for all samples, the result is expressed as the common detection limit, e.g., 10U.

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J = Estimated value. Compound is tentatively identified. Compound was detected below the EPA protocol minimum detection (quantitation) limit.

B = Analyte was found in blank as well as the sample. The data are considered questionable due to possible blank contamination.

radioactive materials as defined by instrument detection limits, or nonroutine wastes (without special approval) may be accepted by the landfill. A listing of the types of wastes that are currently disposed of in the present landfill is provided in Appendix I
(Closure Plan - Present Landfill, "Treatment and Disposal of Solid Waste and Hazardous Waste") of the Post-Closure Care Permit Application.

When in operation, the West Spray Field was irrigated with liquid from Solar Evaporation Ponds 207-B North and Center. In general, the major contaminants in the water from Pond 207-B North were nitrates; the water from Pond 207-B Center was characterized by an elevated pH. Above background levels of radioactive substances may also have been applied to the West Spray Field on some occasions. Data concerning the composition of the water previously contained in Solar Ponds 207-B North and Center during the years of the West Spray Field's operation can be found in Appendix I-4 (Closure Plan - West Spray Field, "Characteristics") of the Post-Closure Care Permit Application.

#### 2.1.5 <u>Annual Waste Volumes/Pretreatment Methods</u>

In 1985, Solar Pond 207-A received approximately 42,000 gallons of waste. The placement of waste materials directly into this pond ceased in 1986. Estimates of the maximum volumes of wastes that potentially may be contained in the solar ponds between the present dates and closure can be found in Appendix I-2 (Closure Plan - Solar Ponds, "Maximum Waste Inventory") of the Post-Closure Care Permit Application.

The present landfill receives an estimated 115 cubic years per work day of waste. None of this waste is pretreated prior to disposal. According to information contained in Appendix I-3 (Closure Plan - Present Landfill, "Volume of Waste") of the Post-Closure Permit Application, the current total volume of waste in the landfill is 330,000 cubic yards. It is estimated that the landfill received approximately 20 cubic yards of compacted waste per work day for its first ten years of operation, approximately 30 cubic yards of compacted waste per work day from 1978 to 1986, and 115 cubic years per work day between 1986 and 1988.

The monthly volumes of liquid from Ponds 207-B North and Center that were applied to the West Spray Field during 1982 to 1985 can be found in Appendix I-4. (Closure Plan - West Spray Field, "Application Rate") of the Post-Closure Care Permit Application. It is estimated that during the years of the spray field's operation, the total applications from Ponds 207-B North and Center were 9,013,000 and 57,363,000 gallons, respectively. Irrigated areas of the field received liquid from one or both ponds. Thus a maximum application of approximately 66,376,000 gallons occurred in the areas of the spray field that received liquid from

both ponds. The water applied to the fields was pumped from the solar evaporation ponds without pretreatment.

#### 2.1.6 Government Agencies Which Inspect Unit Operations

The Colorado Department of Health (CDH) has inspected the solar ponds and landfill for compliance with hazardous and solid waste regulations. Data has been supplied to the State for their records. The environmental impacts of the Plant are monitored by the Environmental Protection Agency (EPA), CDH, Jefferson County, and the City of Broomfield. Monitoring data from these agencies are presented in Attachment 7. Descriptions of the surface water, air, and soil monitoring programs and discussions of the data may be found in Sections 2.2.2.4 and 2.2.2.5 (surface water), 2.2.3.1 and 2.2.3.2 (air), and 2.2.5.1 (soil).

Surface water discharges from the Plant are regulated under an EPA National Pollutant Discharge Elimination System (NPDES) permit. Although the NPDES permit does not specifically cover any of the subject units, a technical violation of the NPDES permit occurred in October 1984 due to a release from the West Spray Field. The violation was caused when run-off from spray irrigation bypassed the Plant surface water holding ponds and carried nitrates into McKay Ditch. Although the nitrate concentrations were below discharge limits, the release was considered in violation since it did not go through an NPDES-designated outfall.

#### 2.2 PATHWAY SPECIFIC INFORMATION

#### 2.2.1 Groundwater

#### 2.2.1 Maps of Well Locations within Three Miles of the Units

A map of the supply wells located within three miles of the solar ponds is presented in Plate I (see Attachment 3). Well locations were taken from records obtained from the Colorado Engineer's Office. An attempt was made to physically locate the two wells (wells No. 11 and 12) that were reportedly the closest downgradient wells to the subject units (approximately 1.8 miles east of the solar ponds). These wells could not be located. land on which these wells are supposedly located has been owned by the City of Broomfield since 1963. City employees had no knowledge of the wells. The locations of the other registered wells have not been verified in the field. However, it is assumed for the purposes of this report that wells no. 1 and 8, which are reportedly located approximately 2.4 miles northeast of the solar ponds (see Plate I in Attachment 3), are the closest existing downgradient wells.

A list of all wells registered with the Colorado State Engineer that are within three miles of the three units may be found in Table 2-4. The locations and uses of these wells are indicated

in that table. There are no existing maps that specifically indicate wells that are located within three miles of the West Spray Field and the present landfill. However, with the exception of wells no. 66, 67, and 68 (as listed in Table 2-4), all of the registered wells situated within three miles of the landfill and West Spray Field are shown in Plate I (see Attachment 3). Table 2-5 summarizes the number of wells located within three miles of each unit that are used as a drinking water source.

#### 2.2.1.2 Groundwater Usage

The uses of the wells located within three miles of each unit are presented in Table 2-6. These data are summarized from the information in Table 2-4.

Most of the wells located within three miles of the solar evaporation ponds (27 out of 53) are used as a source of human drinking water. These include 22 residential wells and five municipal wells. Nine wells are used for industrial/commercial purposes; twelve to water stock; and two for irrigation.

The majority of the wells (21 out of 38) situated within three miles of the present landfill are also used to supply human drinking water. These include 18 residential wells and three municipal wells. Eight wells are used for industrial/commercial purposes and six are used to water stock.

Of the wells located within three miles of the West Spray Field, seven out of 27 are used for industrial/commercial purposes. Six wells are used to supply residential drinking water and two are used to water stock.

The nearest known wells (see section 2.2.1.1) that are downgradient to the three subject units are wells no. 1 and 8. According to the Colorado State Engineer's Records, well no. 1 is a domestic well and well no. 8 is a municipal well (see Table 2-4). These two wells are located approximately 2.4, 2.5, and 3.8 miles, respectively, from the solar ponds, present landfill, and West Spray Field.

#### 2.2.1.3 Regional Recharge/Discharge Map

Groundwater flow at the Rocky Flats Plant occurs in two hydraulically connected systems. There is a shallow flow in the Rocky Flats Alluvium and valley fill materials, and a deeper flow in the claystones and sandstones of the Arapahoe formation. The alluvium is up to 98 feet thick west of the Plant, but is completely eroded to the east.

TABLE 2-4

WELLS REGISTERED WITH THE COLORADO STATE ENGINEER
WITHIN A THREE MILE RADIUS OF SOLAR PONDS,
PRESENT LANDFILL, AND/OR WEST SPRAY FIELD

Ref.	Permit	Quarter	Loc	ation		Use	Est. zone of	Owner	Units within
No.	Number	Qual tel	Sec.	Tsp.	Rng.	use	Completion	Owner	3 miles
1	24243	SW/SW	31	T.15.	R.69 W.	1	KA/KFL	Hardaway, R.	L,S
2	29289	SW/SW	31	T.1S.	R.69 W.	3	KA/KFL	Hardaway, R.	L.S
3	34582	SW/SE	31	T.1S.	R.69 W.	1	KA	Heath, G.D.	L,S
4	113864	NW/SW	31	T.1S.	R.69 W.	0	Unk	Waitman, D.B.	L.S
5	119287	SW/NW	31	T.1S.	R.69 W.	1	Unk	Roberts, B.A.	L,S
6	108871	NW/NW	31	T.1S.	R.69 W.	1	Unk	Smith, M.R.	L,S
7	28678F	SE/NW	6	T.25.	R.69 W.	8	Unk	Carlson, C.F.	L.S
8	23591F	SW/NE	6	T.2S.	R.69 W.	8	Unk	Jeffco Air Pk	L,S
9	23590F	NE/NE	6	T.2S.	R.69 W.	8	Unk	Jeffco Air Pk	L.S
10	28779	SW/SW	6	T.2S.	R.69 W.	1	Qa	McCadden, R.D.	L.S
11	9126	NE/NW	7	T.2S.	R.69 W.	1	Qa	McCadden, R.D.	L,S
12	15044R	SW/NW	17	T.25.	R.69 W.	5	KA	Lyons, M.D.	S
13	132576A	SE/SE	18	T.2S.	R.69 W.	3	Unk	Woodis, B.J.	L,S
14	103583A	SE/SE	18	T.25.	R.69 W.	3	Unk	Brauch, K.	L.S
15	96282	NE/SE	18	T.2S.	R.69 W.	0	Unk	Brauch, T.	L.S
16	29620	NE/SE	18	T.2S.	R.69 W.	1	KA	Brauch, D.	L,S
17	52028	SE/SE	18	T.2S.	R.69 W.	2	KA	Brauch, K.	L.S
18	132562	SE/SE	18	T.2S.	R.69 W.	3	Qa	Woodis, B.J.	L,S
19	132563	NE/NE	18	T.2S.	R.69 W.	1	Qa	Woodis, B.J.	L.S
20	26730F	NW/NW	19	T.25.	R.69 W.	6	Unk	Cook, M.E.	S
21	264942F	NE/NW	19	T.2S.	R.69 W.	8	Unk	Cook, M.E.	S
22	131841	NE/NW	19	T.2S.	R.69 W.	6	Unk	Cook, M.E.	S
23	26937F	NW/NW	19	T.2S.	R.69 W.	8	Unk	Cook, M.E.	S
24	31058F	NE/NW	19	T.25.	R.69 W.	3	KL	Babb, M.A.	S
25	032349F	NW/NW	19	T.2S.	R.69 W.	3	KL	Phillips, H.F.	S
26	12307R	NE/NE	26	T.1S.	R.70 W.		Unk	Wilson, T.L.	L
27	016207F	NW/SW	28	T.1S.	R.70 W.	4	Unk	Cinaquanta, F.	L
28	2862	SW/NW	33	T.1S.	R.70 W.	. 1	Unk	Weaver, J.E.	L,S,F
29	88218	NW/NE	34	T.1S.	R.70 W.		Unk	Hill, T.C.	L,S,F

TABLE 2-4 Continued

# WELLS REGISTERED WITH THE COLORADO STATE ENGINEER WITHIN A THREE MILE RADIUS OF SOLAR PONDS, PRESENT LANDFILL, AND/OR WEST SPRAY FIELD

Ref.	Permit	Quarter	Loc	ation		Use	Est. zone of	Owner	Units within
No.	Number	Qual cei	Sec.	Tsp.	Rng.	036	Completion	Owner	3 miles
30	15060	NW/NE	36	T.1S.	R.70 W.	1	KA	Swanson, H.L.	L,S
31	130482	NE/SE	36	T.1S.	R.70 W.	1	Unk	Verhey, R.J.	L.S
32	2651F	SW/NE	5	T.2S.	R.70 W.	5	Qa	Idealite Co.	L,S,F
33	3338	SE/NE	5	T.2S.	R.70 W.	1	Qa	Hogan, E.J.	L.S.F
34	91184	SW/SW	7	T.2S.	R.70 W.	1	Unk	Ranson, A.L.	F
35	42120	NE/NE	8	T.25.	R.70 W.	i	Unk	Daniels, W.H.	L,S,F
36	28915	NW/SW	9	T.2S.	R.70 W.	2	Qa	Church, M.F.	L,S,F
37	17190F	NE/SE	16	T.25.	R.70 W.	4	KFL	Co. Land Comm.	L.S.F
38	31889F	NE/NW	19	T.2S.	R.70 W.	2	Unk	Blue Mtn. Est.	
								Water District	S
39	31871F	NE/NW	19	T.25.	R.70 W.	3	JM/Kd	Blue Mtn. Est.	
								Water District	S
40	72601R	SE/NW	19	1.25.	R.70 W.	0	Unk	Snow, R.A.	· S
41	3257	NW/NE	21	T.2S.	R.70 ₩.	1	KFL	Church, M.F.	L,S,F
42	30549F	SW/SE	21	T.2S.	R.70 W.	9	Landfill	Landfill, Inc.	L,S,F
43	30550F	SW/SE	21	T.2S.	R.70 ₩.	9	Landfill	Landfill, Inc.	L,S,F
44	033083F	SW/SE	21	T.25.	R.70 W.	9	Landfill	Landfill, Inc.	L,S,F
45	10003F	NE/SE	22	T.2S.	R.70 W.	. 5	KFL	Oil Shale Corp	L.S.F
46	23787F	NE/NE	22	T.2S.	R.70 W.	. 4	Unk	Cillissen, A.M	. L,S,F
47	131860	NE/SE	23	T.2S.	R.70 W.	. 4	Unk	Storm, B.P.	L,S,F
48	131861	NE/SE	23	T.25.	R.70 W.	4	Unk	Bartel, L.G.	L,S,F
49	2679F	SW/NE	24	T.2S.	R.70 W.	. 5	KA	Boise Cascade	L.S
50	20196	NW/SE	24	T.2S.	R.70 W.	. 3	KA	Westminster C.	
51	34955	SE/SE	24	T.2S.	R.70 W.	. 1	KA	Stevens, D.N.	S
52	34149	NW/NW	25	1.25.	R.70 W.	. 1	KA	Mentgen, G.	S
53	34541	NW/NE	25	T.2S.	R.70 W.	. 1	KA	Collicott, D.W	. \$
54	35405	NW/NE	25	T.2S.	R.70 W.	. 1	KA	Collicott, D.W	
55	78493	SE/NW	26	T.25.	R.70 W	. 2	Unk	Harkness, W.W.	S,F
56	29564M	NW/SW	27	T.25.	R.70 W		KL	RPS, Inc.	F
57	24583F	SE/NH	27	T.25.	R.70 W		Unk	Public Service	s,F
58	29573M	NW/NE	28	T.25.	R.70 W		KL	RPS, Inc.	F

#### TABLE 2-4 (Continued)

## WELLS REGISTERED WITH THE COLORADO STATE ENGINEER WITHIN A THREE MILE RADIUS OF SOLAR PONDS, PRESENT LANDFILL, AND/OR WEST SPRAY FIELD

Ref. No.	Permit Number	Quarter		ation Tsp.	Rng.	Use	Est. zone of Completion	0wner	Units within 3 miles
59	29572H	NW/NE	28	T.2S.	R.70 W.	9	KL	RPS, Inc.	F
60	29571H	NW/NE	28	T.2S.	R.70 W.	9	KL	RPS, Inc.	F
61	29569M	SE/NE	28	T.2S.	R.70 W.	9	KL	RPS, Inc.	F
62	29568M	NE/SE	28	T.25.	R.70 W.	9	KL	RPS, Inc.	F
63	29567M	SW/NE	28	T.25.	R.70 W.	9	KL	RPS, Inc.	F
64	29566M	NW/SE	28	T.25.	R.70 W.	9	KL	RPS, Inc.	F
65	29565M	NE/SE	28	T.2S.	R.70 W.	9	KL	RPS, Inc.	F

	USES:	0	Household	(indoor)	use onl	v
--	-------	---	-----------	----------	---------	---

- 1 Domestic (indoor and outdoor) use
- 2 Stock
- 3 Domestic and stock
- 4 Commercial

#### 5 Industrial

- 6 Irrigation
- 7 Domestic and Irrigation
- 8 Municipal
- 9 Other

#### Estimated Zone of Completion:

- Qa Quaternary alluvium
- KA Arapahoe Formation
- KFL Fox Hills Laramie Aquifer
- Unk Unknown
- JM Morrison Formation
- Kd Dakota Formation

UNITS: L = Present Landfill

S = Solar Evaporation Ponds

F - West Spray Field

TABLE 2-5

NUMBER OF WELLS THAT ARE USED AS A DRINKING WATER SOURCE
WITHIN THREE MILES OF EACH UNIT

	Drinking Water Usage			
Unit	Human Only	Stock Only	Human and Stock	Total
Solar Evaporation Ponds	22	4	8	34
Present Landfill	18	2	4	24
West Spray Field	6	2	0	8

NOTE: Some wells are located within three miles of more than one subject unit. These wells are included in the data for each applicable unit.

TABLE 2-6

NUMBER OF WELLS BY USAGE WITHIN THREE MILES OF THE SOLAR PONDS, PRESENT LANDFILL, AND WEST SPRAY FIELD

	Number		
Usage	Solar Eva- poration Ponds		West Spray Field
Domestic/Household	22	18	6
Stock	4	2	2
Domestic and Stock	8	4	0
Commercial/Industria	9	8	7
Irrigation	2	0	0
Municipal	5	3	0
Other	3	3	. 12
TOTAL	53	38	27

NOTE: Some wells are located within three miles of more than one subject unit. These wells are included in the data for each applicable unit.

Recharge and discharge areas and the potentiometric surface of the Arapahoe Formation are shown in Figure 2-1. There is no existing map showing recharge/discharge areas of the alluvium and valley fill materials.

The shallow system in the alluvium and valley fill materials is recharged by incident precipitation and infiltration from creeks, ditches, ponds, and spray evaporation/irrigation systems. Water is discharged through spring flow along the edge of the alluvium and through baseflow to Walnut and Woman Creeks. Water in these materials also recharges the underlying bedrock. Groundwater flow is generally to the east, but also toward the creeks.

The majority of the groundwater flow in the Arapahoe Formation occurs in the lenticular sandstone bodies contained within the claystones. Recharge to the sandstones occurs where they subcrop beneath surficial materials or by downward leakage through the claystones. Discharge occurs along stream valleys as baseflow and as well discharge. Groundwater flow in the vicinity of the Plant is to the east toward the area of regional discharge along the South Platte River.

#### 2.2.1.4 Net Precipitation Data

Summaries of the average monthly water-equivalent precipitation (rain, snow, etc.) for the years 1953-1976 and of the total monthly precipitation for the year 1987 are presented in Table 2-7. Data collected after 1976 have not yet been included in the climatological data base. However, the 24-year period of record (1953-1976) is considered representative of Plant climatology.

Using the 24-year average total precipitation value of 38.5 cm (15 inches) as representative of the mean annual precipitation and an estimate of 121.9 cm (48 inches) as the average evaporation rate (National Weather Service, Denver Regional Office), the net precipitation is calculated to be minus 83.4 cm (minus 32.8 inches).

#### 2.2.2 <u>Surface Water</u>

### 2.2.2.1 <u>Maps of Surface Water Bodies within Three Miles of the Units</u>

Surface water bodies located within three miles of the solar ponds, present landfill, and West Spray Field are shown in Plate II (Attachment 4). Surface water holding ponds located at the Rocky Flats Plant are shown in Figure 2-1.

TABLE 2-7

MONTHLY PRECIPITATION
AT THE ROCKY FLATS PLANT

Precipitation in Centimeters (cm)

	24-Year Average (1953-1976)	1987*
January	1.27	_
February	1.65	-
March	3.10	-
April	4.34	-
May	7.32	-
June	4.29	-
July	3.50	-
August	3.02	-
September	4.09	-
October	2.51	-
November	2.06	-
December	1.35	-
Annual Precipitation	38.50 cm	40.85

<sup>\*</sup> Monthly precipitation values not available from the annual monitoring report

#### 2.2.2.2 Surface Water Usage

Great Western Reservoir is the only surface water body with a major use that is located within a 3-mile radius of any of the three units. Situated within three miles of the solar ponds and the present landfill, the reservoir serves as a drinking water source for approximately 27,307 (based on 1987 census) people in the City of Broomfield. Although a number of other surface water bodies, including Rocky Flats Lake, are located within three miles of one or more of the subject units, they have no known major usages.

Standley Lake, which supplies drinking water to the cities of Westminster, Northglenn, and Thornton, is located approximately four miles from the Plant perimeter. Standley Lake also is used for irrigation and recreational purposes.

#### 2.2.2.3 Local Surface Water Flow Rates

The flow of the surface waters passing through the Rocky Flats Plant site (North Walnut Creek, South Walnut Creek, Woman Creek) is intermittent. Surface water flow measurements are taken at four locations: below ponds A-4, B-5, and C-2 and on Walnut Creek at Indiana Street. Ponds A-4 and B-5 discharge into Walnut Creek. Pond C-2 discharges into Woman Creek. Flow rates are measured below the ponds only during controlled discharges. Pond water is released when the pond volume is at 10 percent of capacity. Flow is continuously monitored at the Walnut Creek station.

The maximum, minimum, and average flow rates and the total gallons measured at these monitoring locations during 1984 and 1985 are summarized in Table 2-8. The pond data are from measurements taken during the 24-hour period following discharges. The data for Walnut Creek reflect the total drainage passing through that station during the year.

#### 2.2.2.4 Surface Water Monitoring Systems

#### Rocky Flats Plant Monitoring Program

Two main surface water monitoring programs are conducted by the Rocky Flats Plant. One is for surface run-off/effluents leaving the Plant. The other is for regional water systems off the Plant site.

Discharges from the Rocky Flats Plant are monitored for compliance with appropriate Colorado Department of Health (CDH) standards (Colorado Department of Health, 1981) and EPA National Pollutant Discharge Elimination System (NPDES) permit limitations

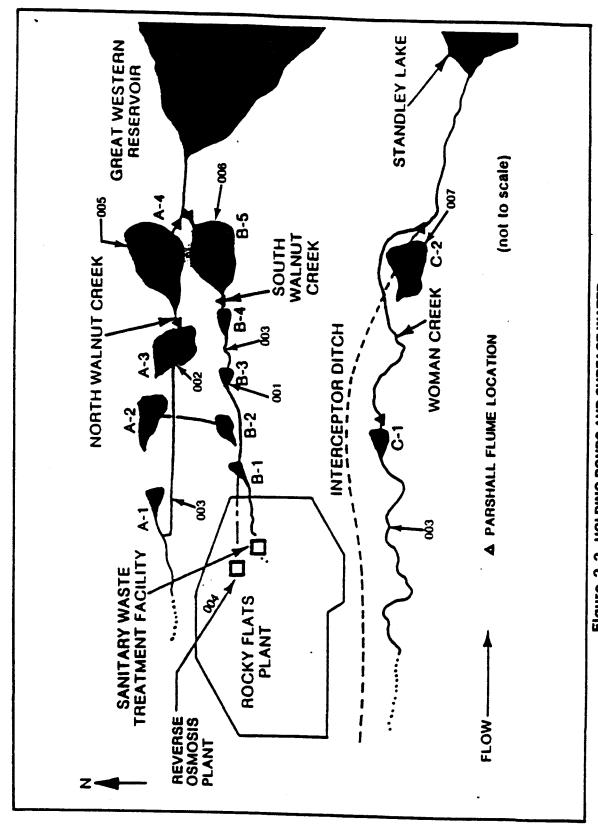


Figure 2-2 HOLDING PONDS AND SURFACE WATER NPDES PERMIT MONITORING LOCATIONS (001-007)

TABLE 2-8

FLOW RATES (GALLONS/DAY) OF SURFACE WATERS
AT THE ROCKY FLATS PLANT

Location		1984	1985
Pond A-4	minimum mumixam	234,000 9,003,000	832,000 2,352,000
Total gallons	released	76,019,000	23,273,000
Pond B-5	minimum mumixam	4,000 1,842,000	40,000 2,031,000
Total gallons	released	32,008,000	35,751,000
Pond C-2	minimum maximum	284,000 2,693,000	2,264,000 3,512,000
Total gallons	released	13,253,000	5,776,000
Walnut Creek (at Indiana St.)	minimum maximum	0* 11,526,000	0* 9,321,000
Total gallons	recorded	217,584,000	140,405,000

<sup>\*</sup> The flow in Walnut Creek is intermittent.
for Walnut Creek reflect the total drainage passing through that
station during the year.

(NPDES Permit CO-0001333). The NPDES discharge locations, numbered 001-007, are identified in Attachment 5A and illustrated in Figure 2-2. The NPDES permit places monitoring and reporting requirements and limitations on daily concentrations and monthly average concentrations for specific parameters. Reports are routinely filed with the EPA in accordance with NPDES permit requirements and copies are sent to CDH.

Prior to discharge from Ponds A-4, B-5, and C-2, water is sampled and analyzed for gross alpha, gross beta, tritium, gamma activity, pH, nitrate as nitrogen, and nonvolatile suspended solids. Water is not released if the Plant action level for any parameter is exceeded. During releases from Ponds A-4, B-5, and C-2, the water is sampled continuously. The samples are analyzed for plutonium, uranium, americium, tritium, pH, nitrate as N, and nonvolatile suspended solids. Water also is sampled continuously and collected daily from the outfall of Pond C-1 and from the Walnut Creek at Indiana Street sampling station when there is flow. Daily samples are composited weekly for plutonium, uranium, and americium analyses. Daily samples from Pond C-1 and Walnut Creek at Indiana Street are analyzed for tritium.

Regional water monitoring by the Plant includes sampling and analysis of public water supplies and tap water from several surrounding communities. Of the regional water supplies, only Great Western Reservoir and Standley Lake receive run-off from Rocky Flats drainage systems. Water samples are collected weekly from Great Western Reservoir, one of two supplies for the City of Broomfield, and from Standley Lake, a water supply for the City of Westminster and portions of the Cities of Thornton and Northglenn. The weekly samples are composited monthly and analyzed for plutonium, uranium, and americium concentrations. Each weekly sample is analyzed for tritium. Annual grab samples also are collected from three regional reservoirs (Ralston, Dillon, and Boulder) and one stream (South Boulder Diversion Canal) at distances ranging from 1.6 to 96 kilometers (1 to 60 miles) from the Plant. These samples are collected to determine background data for plutonium, uranium, americium, and tritium in water.

Drinking water from Boulder, Broomfield, and Westminster is collected weekly, composited monthly, and analyzed for plutonium, uranium, and americium. Tritium analyses are performed on weekly grab samples. Quarterly grab samples of tap water are collected from the surrounding communities of Arvada, Denver, Golden, Lafayette, Louisville, and Thornton. Samples are analyzed for plutonium, uranium, americium, and tritium.

In addition to the monitoring programs for effluents and regional surface waters, samples are also collected monthly from the landfill holding pond. These samples are analyzed for a series of organic, inorganic, and radioactive parameters. The pond con-

tains groundwater collected by drains located at the perimeter of the landfill. The landfill pond water is not discharged off site. The water is spray irrigated onto land adjacent to the pond.

#### Water Monitoring by Government Agencies

The Colorado Department of Health (CDH) samples the surface run-off from the Rocky Flats Plant at several locations. Pond A-3 is sampled monthly and analyzed for gross alpha, gross beta, tritium, and nitrates. Walnut Creek at Indiana Street is sampled three times each week when there is sufficient flow and analyzed for gross alpha, gross beta, tritium, and nitrates. Woman Creek at Indiana Street is sampled monthly when there is adequate flow and analyzed for gross alpha, gross beta, tritium, and nitrates. The treated sanitary effluent in Pond B-3 is sampled weekly and analyzed for gross alpha, gross beta, tritium and nitrates. CDH samples having gross alpha activity of more than 40 x 10<sup>-9</sup> uCi/ml are analyzed for specific plutonium and uranium isotopes.

The City of Broomfield samples surface run-off from the Rocky Flats Plant at the junction of Walnut Creek and Indiana Street daily whenever there is flow and analyzes the samples for gross alpha and beta activity. Sampling and analysis for all parameters in the NPDES permit is periodically performed by the Environmental Protection Agency. CDH and the City of Broomfield also collect surface water samples off site. Samples are analyzed for radioactive parameters.

In the spring of 1986, the Drinking Water Section of the Colorado Department of Health requested that the cities of Thornton, Northglenn, Westminster and Broomfield sample raw and finished water associated with their communities and analyze the samples for specific volatile organic chemicals (VOCs). The City of Broomfield sampled raw water from Great Western Reservoir, finished water from the Broomfield Treatment Plant, and tap water from the City Office Building. Samples collected by the City of Westminster included raw water from Standley Lake and finished water from their distribution system. The City of Northglenn took samples of raw water from Woman Creek and of finished water from their distribution system. The City of Thornton sampled raw water from Woman Creek at Indiana Street. All the water samples were analyzed for the following VOCs: benzene, 1,2-dicholoroethane, 1,1-dichloroethylene, trichloroethylene, carbon tetra-chloride, p-dichlorobenzene, 1,1,1-trichloroethane, and vinyl chloride. In addition, the sample taken by the City of Thornton from Woman Creek at Indiana Street also was analyzed for methylene chloride, 1,1-dichloroethane, trans-1,2-dichloroethylene, 1,2-dichloropropane, cis-1,3-dichloropropane, 1,1,2-trichloroethane, trans-1,3-dichloropropane, 1,1,2,2-tetrachloroethane, 1,1,2,2-tetrachloroethylene, and chloro-benzene.

#### 2.2.2.5 Surface Water Quality Data

#### On-Site Data Collected by the Rocky Flats Plant

On-site surface water monitoring data collected by the Rocky Flats Plant during 1987 are presented in Attachment 5 (A, B, and C). The data summaries are reproduced from the 1987 Annual Environmental Monitoring Report (Rockwell International, 1987 [sic]).

Contaminant levels at the sampling locations listed in Attachment 5 (A-C) reflect discharge and run-off from the Plant site in general. The data for pond A-3 reflect some groundwater seepage from the solar ponds. There is no surface water drainage from the landfill area.

Run-off from the West Spray Field could potentially affect Walnut and Woman Creeks. Only one incident of such run-off to Walnut Creek has occurred. Management practices were initiated to preclude reoccurrence (see Section 2.5). The West Spray Field is no longer used.

Annual average concentrations of chemical and biological constituents of liquid effluent samples collected from Ponds A-3, A-4, B-3, B-5, and C-2 during 1987 are presented in Attachment 5A. The data are indicative of overall water quality for these ponds. Concentrations of plutonium, uranium, americium, and tritium in water samples from the outfalls of Ponds A-4, B-5, C-1, C-2, and from Walnut Creek at Indiana Street are presented in Attachments 5B and 5C. All plutonium, uranium, americium, and tritium concentrations at these locations were 2.3 percent or less of the Derived Concentration Guides (DCGs). The applicable DCGs are listed in Attachment 5G. The DCGs were calculated based on the DOE interim standard (Rockwell International, 1987 [sic]).

The following paragraphs summarize on-site surface water quality from 1980 to 1987 (Rockwell International, 1987 [sic]):

At the downstream discharge points on Walnut Creek at Indiana Street and Pond C-2 on Woman Creek, maximum plutonium concentrations for the eight-year period were 7.10 ±0.08 x 10<sup>-9</sup> uCi/ml and 0.11±0.7 x 10<sup>-9</sup> uCi/ml, respectively. The maximum uranium concentration in Walnut Creek was 14±3 x 10<sup>-9</sup> uCi/ml and the maximum uranium concentration below Pond C-2 was 6.9±0.6 x 10<sup>-9</sup> uCi/ml. Maximum americium concentrations were 2.1±0.3 x 10<sup>-9</sup> uCi/ml in Walnut Creek and 0.05±0.03 x 10<sup>-9</sup> uCi/ml in Pond C-2. The maximum tritium concentration in Walnut Creek was approximately 1300±600 x 10<sup>-9</sup> uCi/ml and 1200±600 x 10<sup>-9</sup> uCi/ml in Pond C-1. All plutonium, uranium, americium, and tritium concentrations at these locations were 2.3 percent or less of the applicable DCGs (see Attachment 5G). The maximum tritium concentration measured in Pond C-2 from 1981-1987 was 700±600 x 10<sup>-9</sup> uCi/ml. No tritium data were available for Pond C-2 for 1980.

During the seven year period, the maximum nitrate concentrations were approximately 14.0 mg/l in Pond A-4, 9.2 mg/l in Pond B-5, and 2.5 mg/l in Pond C-2. Nitrate concentrations in Pond A-4 decreased slightly over the seven year period, but remained nearly constant in Ponds B-5 and C-2. pH was slightly basic in all of the ponds throughout the eight year period and remained fairly constant. In Pond A-4, pH ranged from approximately 8.4 to 9.0 and averaged 8.7. In Pond B-5, pH again ranged from 8.3 to 9.0 and averaged 8.7. In Pond C-2, pH ranged from 8.7 to 8.5 and averaged 8.3. Maximum nonvolatile suspended solids concentrations in Ponds A-4, B-5, and C-2 were approximately 43 mg/l, 142 mg/l, and 20 mg/l, respectively. The average nonvolatile suspended solids concentration in Pond B-5 was higher than those in Ponds A-4 and C-2 due to dam reconstruction in 1984. The nitrate and suspended solids concentrations and the pH values are typical of values found in regional waters.

Results of three samples collected in 1987 from the landfill pond are listed in Attachment 5F (Appendix 5 of Appendix I-3 Closure Plan-Present Landfill).

#### Off-Site Data Collected by the Rocky Flats Plant

The results of the analysis of samples collected by the Rocky Flats Plant from public water supplies in 1987 are given in Attachments 5D and 5E. Evaluation of the data indicates no unusual results. The plutonium, uranium, americium, and tritium concentrations for the regional reservoirs represent a small fraction (0.5 percent or less) of the DOE interim standard Derived Concentration Guides (DCGs). The average plutonium concentration in Great Western Reservoir was 0.008±0.001 x 10<sup>-9</sup> uCi/ml. Results of the 1987 plutonium, uranium, americium, and tritium data for drinking water in nine communities were within the range that would be expected from atmospheric fallout and natural background radioactivity contributions in this area. All drinking water values were 0.4 percent or less of the applicable DCG.

Drinking water standards have been adopted by the State of Colorado and the Environmental Protection Agency (EPA) for alphaemitting radionuclides excluding uranium and radon (15  $\times$  10 $^{-9}$  uCi/ml), and for tritium (20,000 x 10 $^{-9}$  uCi/ml) (U.S. EPA, 1976). During 1987, the sum of the average concentrations of plutonium and americium (alpha-emitting radionuclides) in each community water sample was 0.03 x 10 $^{-9}$  uCi/ml or less. These values are 0.6 percent or less of the EPA and State of Colorado drinking water standard for alpha activity. The 1987 average tritium concentrations in Great Western Reservoir, Standley Lake, and in all community tap water samples was approximately 200 x 10 $^{-9}$  uCi/ml. These values are typical of background tritium concentrations in Colorado and represent 1.0 percent or less of the EPA and State of Colorado drinking water standard for tritium.

#### Data Collected by Government Agencies

Surface water data collected by government agencies during 1985 and 1987 may be found in Attachment 6. The data include surface water parameters measured by EPA at discharge point 001 (1987), ranges of alpha and beta activity in off-site surface water samples collected by the City of Broomfield (1985), and ranges of radioactive parameters in on- and off-site surface water samples collected by the Colorado Department of Health (CDH) (1985).

The surface water parameters recorded by EPA at discharge point 001 below holding pond B-3 (Attachment 6A) were less than or within NPDES limits. The values measured by CDH were similar to the mean 1985 values measured by the Rocky Flats Plant at the same location (see Attachment 6A).

The values for alpha and beta activity that were recorded in offsite surface water samples collected by the City of Broomfield
(Attachment 6B) are typical of surface waters in the area. The
values were all less than the City's guidelines for increased
monitoring and decision levels for gross alpha and gross beta
(City of Broomfield, 1985). The increased monitoring level for
gross alpha or gross beta is 20 picoCuries per liter. If a sample reaches this level, the City will increase the monitoring
frequency and notify all appropriate City staff and agencies.
The decision level for gross alpha or gross beta is 50 picoCuries
per liter. If gross alpha or gross beta reaches this level, the
City will increase the monitoring frequency, notify the appropriate staff and agencies, split samples to verify the
radioanalysis results and switch over the Broomfield Service Area
to the Denver water system.

The ranges of values for gross alpha and gross beta activity recorded in off-site surface waters by CDH (Attachment 6C) were similar to those measured by the City of Broomfield. The tritium levels were less than 1 percent of the DCG for tritium in water available to members of the public. The values for uranium that were measured in on- and off-site surface waters by the CDH (Attachment 6D) were all 2.5 percent or less of the DCG for drinking water (see Attachment 5G). The off-site values were similar to those measured by the Rocky Flats Plant at comparable sampling locations (see Attachment 5D).

The analyses of samples of raw and treated water collected in the spring of 1986 by the Cities of Broomfield, Westminster, Northglenn, and Thornton indicated that there were no volatile organics (VOCs) present in these samples at or above detection limits. The detection limits for all VOCs except vinyl chloride were in the range of 1-5 ug/l; the detection level for vinyl chloride was 10 ug/l.

#### 2.2.3 Air

#### 2.2.3.1 Air Monitoring Systems

Air on and in the vicinity of the Rocky Flats Plant is monitored for both radioactive and nonradioactive substances. Air monitoring is conducted both by the Plant and by state and local agencies. The following sections regarding air monitoring by the Plant are reproduced in part from the 1987 <u>Annual Environmental Monitoring Report</u> (Rockwell International, 1987a [sic]).

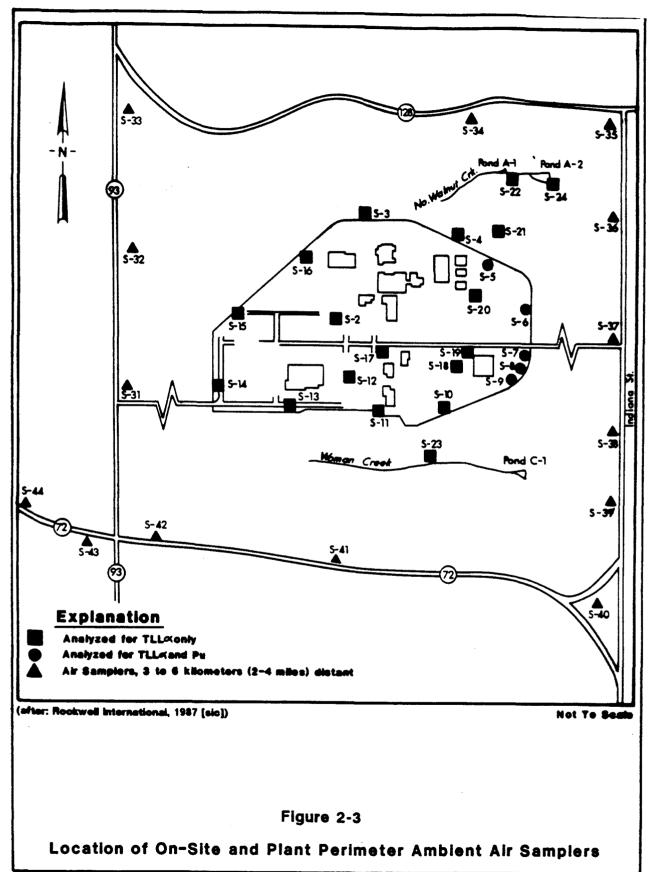
#### Radioactive Ambient Air Monitoring by the Rocky Flats Plant

High-volume ambient air samplers are located on the Rocky Flats Plant, at the Plant perimeter, and in surrounding communities. The air samplers operate continuously at a volume flow rate of approximately 12 l/sec (25 ft<sup>3</sup>/min). Forty-nine of the samplers were installed between 1974 and 1976. The Lakeview Pointe and Cotton Creek Samplers were added in 1982 and 1984, respectively.

Airborne particulates in ambient air are sampled continuously at 23 locations within and adjacent to the Rocky Flats exclusion area (Figure 2-3). The sample filters are collected biweekly and analyzed for total long-lived alpha (TLLa). If the TLLa concentration for an ambient air sample exceeds the Plant guide value (10 x  $10^{-15}$  uCi/ml), a specific plutonium analysis is performed. Filters from 5 of the 23 samplers also are analyzed biweekly for plutonium. These five samplers are those that have historically shown the highest plutonium concentrations for the on-site sampling network.

Samples of airborne particulates are collected on filters by high-volume air samplers at 14 locations along or near the Plant perimeter. The perimeter samplers are located between 2 and 4 miles from the Plant center (Figure 2-3). Samplers from each location are collected biweekly, composited by location, and analyzed monthly for plutonium.

Samples of airborne particulates also are also collected at 14 locations in or near communities in the vicinity of the Rocky Flats Plant. These locations, shown in Figure 2-4, are Boulder, Broomfield, Cotton Creek, Denver, Golden, Jeffco Airport, Lafayette, Lakeview Pointe, Leyden, Marshall, Superior, Wagner, Walnut Creek, and Westminster. Sample filters are collected biweekly, composited by location, and analyzed monthly for plutonium radioactivity.



#### Nonradioactive Ambient Air Monitoring by the Rocky Flats Plant

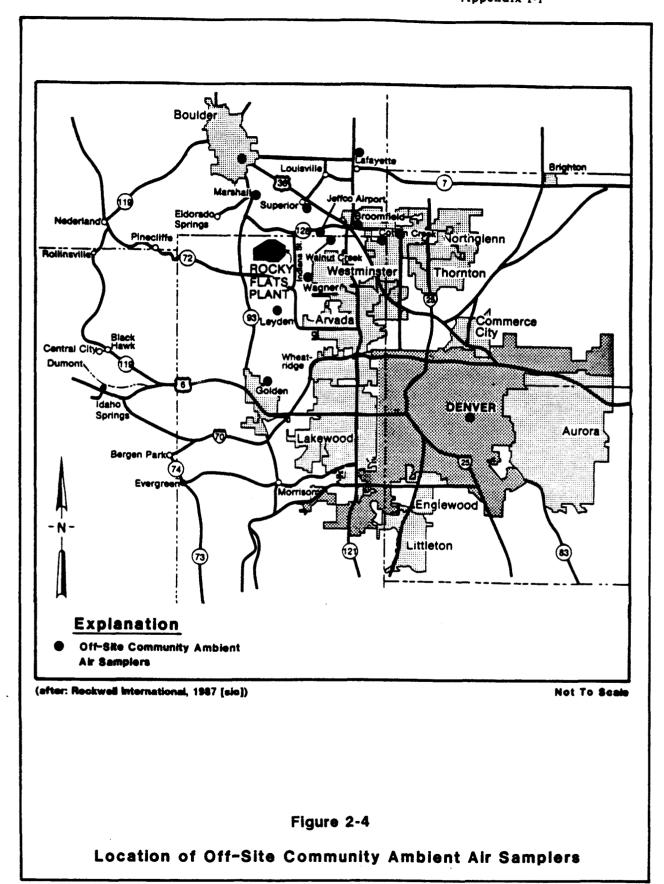
Nonradioactive monitoring of ambient air includes the following: total suspended particulates (TSP), ozone, sulfur dioxide, carbon monoxide, nitrogen dioxide, and lead. These six parameters are criteria pollutants regulated by the EPA and the State of Colorado through the Clean Air Act Amendments of 1970 and 1977, which includes the National Ambient Air Quality Standards (NAAQS) (Clean Air Act, 1981a), and Colorado Air Quality Control Commission Ambient Air Standards (Code of Colorado Regulations, 1975-1979). Prior to July 1986, this monitoring utilized instrumentation in a self-contained van equipped for Mobile Ambient Air Monitoring (MAAM). A new ambient air monitoring shelter was installed during July-August 1986 adjacent to the old facility to ensure continuity and comparability of data. All ambient analyzers and support equipment were transferred from the MAAM van to the shelter in September and recalibrated in the new facility.

During 1987, the values for all of the analyzed criteria pollutants (TSP, lead, sulfur dioxide, carbon monoxide, nitrogen dioxide, and ozone) were measured at 30 percent or less or any applicable limits or guidelines, with the exception of TSP and ozone. The highest TSP value for 1987 (a 24-hour sample) was 100 micrograms per cubic meter (ug/m³), which is 38 percent of the primary 24-hour National Ambient Air Quality Standard (NAAQS) standard of 260 ug/m³. The annual TSP geometric mean value for 1987 was 41 ug/m³, which is 55 percent of the NAAQS primary annual geometric mean standard of 75 ug/m³.

The maximum one-hour 1987 ozone value was 0.135 parts per million (ppm), which is 112 percent of the NAAQS primary one-hour standard of 0.120 ppm. The second highest one-hour ozone value, which occurred during the same afternoon in August, was 0.134 ppm. These ozone values are consistent with levels measured in the general Denver metropolitan area during high pollution episodes.

#### Ambient Air Monitoring by Others

The Colorado Department of Health (CDH) operates eight continuous high volume air sampling stations at the Rocky Flats Plant. Four of these samplers  $(D_1-D_4)$  are inside the inner security fence on the east side of the Plant. The four additional samplers  $(D_5-D_8)$  are located at the Plant perimeter, two along Indiana Street to the east of the Plant, one at the West Access Road near Colorado Highway 93, and one on Colorado Highway 128 near the intersection of McCaslin Blvd. The samples are collected three times per week. It is generally the policy of CDH to analyze each on-site sample for TSP, gross alpha activity, and gross beta activity, and to composite monthly for plutonium analysis (Pu-239 and Pu-240, Pu-238 and Am-241).



Additionally, CDH operates continuous high-volume samplers at twelve sites in the Denver metropolitan area and at five remote locations across the state. The off-site monitoring locations are listed in Attachment 8B. The samples are generally analyzed for TSPs, gross alpha activity, and gross beta activity.

In the summer of 1988, some changes occurred in the CDH air sampling program. They are currently collecting samples from air sampling units twice a week.

#### 2.2.3.2 Air Quality Data

Air monitoring data which were collected by the Rocky Flats Plant during 1987 are presented in Attachment 7 and are discussed below. The data summaries are reproduced from the 1987 Annual Environmental Monitoring Report (Rockwell International, 1987 [sic]).

The data reflect ambient air conditions for the Plant site as a whole. It is not possible to determine the nature and magnitude of the contribution, if any, that the individual subject units make to the measured contaminant levels.

#### Radioactivity Data Collected by the Rocky Flats Plant

Attachment 7A contains the average concentrations during 1987 of plutonium in ambient air at selected on-site monitoring stations. The calculated value for the mean concentration at each location is referred to as the "point estimate." For each plutonium concentration point estimate, a Lower Confidence Limit (LCL) and an Upper Confidence Limit (UCL), which define a 95 percent confidence interval, have been included in the attachment. The average concentrations of plutonium in ambient air at the five on-site stations during 1987 ranged from 0.117 x 10<sup>-15</sup> to 1.222 x 10<sup>-15</sup> uCi/ml. These concentrations were less than 6.11 percent of the Derived Concentration Guide (DCG) for inhalation of plutonium by members of the public (see Attachment 6G). During 1987, all TLLa concentrations measured at the 23 monitoring stations within and adjacent to the Rocky Flats exclusion area were below the Plant guide value (10 x 10<sup>-15</sup> uCi/ml).

Attachment 7B presents the average concentrations of plutonium radioactivity in airborne particulates at the Plant perimeter sampling stations, S-31 through S-44. The average concentration of plutonium in ambient air at these locations during 1987 was  $0.005 \times 10^{-15} \, \text{uCi/ml}$ . This concentration was 0.03 percent of the DCG for inhalation of plutonium by members of the public. Attachment 7C presents the average concentrations of plutonium in

airborne particulates at the community stations during 1987. The average concentration of plutonium in ambient air at the community stations was  $0.003 \times 10^{-15}$  uCi/ml. This value is 0.02 percent of the DCG for inhalation of plutonium by members of the public.

Throughout their years of operation, all on-site samplers have recorded annual mean concentrations of plutonium of less than 7 percent of the current DCG for inhalation of class W plutonium by the public  $(0.02~\mathrm{pCi/m^3})$ . All perimeter and community samplers have recorded annual mean concentrations below 0.4 percent of the DCG since installation.

## Radioactivity Data Collected by the Colorado Department of Health (CDH)

The on- and off-site air monitoring data collected by the CDH during 1984 and 1985 are summarized in Attachment 8A. The ranges for long-lived alpha (TLLa) and long-lived beta (TLLb) in on-site samples did not exceed those measured in both local (metropolitan) and remote (background) off-site samples. The sampling results for TLLa were within the Plant guide value of 10 x  $10^{-5}$  uCi/ml. The plutonium concentrations measured in on-site samples by CDH were similar to those measured in samples collected by the Rocky Flats Plant (see Attachment 7A).

In the summer of 1988, some changes occurred in the CDH air sampling program. They are currently collecting samples from air sampling units twice a week.

#### Nonradioactivity Data Collected by the Rocky Flats Plant

The nonradioactivity air sampling data for 1987 are summarized in Attachment 8D. The sampling results are all below current NAAQS standards (Clean Air Act, 1981a).

The highest TSP value recorded (a 24-hour sample) was 100  $ug/m^3$ , which is 38 percent of the 24-hour NAAQS primary standard of 260  $ug/m^3$ . The annual geometric mean value for 1987 was 41  $ug/m^3$ , which is 55 percent of the NAAQS primary annual geometric mean standard of 75  $ug/m^3$ .

During 1987, a total of 8,143 1-hour ozone samples were collected. The maximum 1-hour value was 0.135 ppm, which is 112 percent of the NAAQS primary 1-hour standard of 0.120 ppm. The second highest 1-hour ozone value, which occurred during the same afternoon in August, was 0.134 ppm. These values are consistent with levels measured in the general Denver metropolitan area during high pollution episodes.

The maximum one-hour sulfur dioxide  $(SO_2)$  value recorded at the Plant in 1987 was 0.025 ppm. The maximum observed 3-hour average value was 0.021 ppm, which is 4 percent of the NAAQS 3-hour standard of 0.500 ppm. The calculated annual arithmetic mean value of 0.003 ppm is 10 percent of the NAAQS annual mean standard of 0.030 ppm. The maximum observed 24-hour average for  $SO_2$  was 0.010 ppm, which is 7 percent of the NAAQS 24-hour standard of 0.140 ppm.

The 8,400 hourly averages of carbon monoxide (CO) data collected during 1987 yielded an annual arithmetic mean of 0.69 ppm, including a maximum one-hour average value of 6.5 ppm, which is 19 percent of the NAAQS primary 1-hour standard of 35 ppm. A maximum 8-hour average concentration value of 2.30 ppm was recorded, which is 25 percent of the nine-hour NAAQS primary standard of 9 ppm.

The nitrogen dioxide ( $NO_2$ ) data contain 7,500 hourly averages of continuous sampling and gave an arithmetic mean of 0.005 ppm, which is 10 percent of the NAAQS primary mean standard value of 0.05 ppm. The maximum 1-hour value noted during this time period was 0.064 ppm.

#### 2.2.3.3. Population Density

Based on 1980 Census Tract Data, it is estimated that 1,585 individuals live within four miles of the Rocky Flats Plant. Because a buffer zone of 6,116 acres is maintained by the Plant, no one resides or is expected to reside closer than approximately two miles from the Plant. Population density is greater to the south and east of the Plant. Approximately 5,800 persons are employed at the Plant.

#### 2.2.4 Subsurface Gas

#### 2.2.4.1 Municipal-Type Wastes

Solar Pond 207-B South has received product water from the sewage treatment plant; this water was subsequently pumped from 207-B South, processed through the Reverse Osmosis Plant, and recycled for use in the Steam Plant or cooling towers. Solar Pond 207-B Center received tertiary treated sanitary sewage water, which was disposed of by spray irrigation. The tertiary treatment process produces an effluent that is low in suspended solids and BOD. The effluent meets all NPDES permit requirements for off-site release. Solar Pond 207-A received some sanitary sewage sludge. Solar Ponds 207-B North and 207-C have not received municipal type waste. Sanitary sewage product water and sludge currently are not disposed of in the solar ponds.

Municipal-type wastes received by the present landfill include

cafeteria garbage, waste paper, construction debris, and other trash. From 1968 to 1970, about 1,000 kg of sanitary sewage sludge was also disposed of in the present landfill.

#### 2.2.4.2 <u>Underground Conduits</u>

Diagrams of process waste and sanitary sewer pipes at the Rocky Flats Plant site are provided in Attachment 9. Included in the diagrams are those conduits associated with, and in the vicinity of, the solar ponds. Diagrams of all on-site conduits were not provided, as they may contain sensitive information. Diagrams of the total conduit network are available to authorized individuals upon request.

#### 2.2.4.3 <u>Subsurface Gas Monitoring Systems</u>

There are no subsurface gas monitoring or control systems at the Rocky Flats Plant. Studies are currently in progress to determine whether a gas collection system is necessary (Post-Closure Care Permit Application, Appendix I-3, Closure Plan - Landfill, "Gas Collection"). About ten years ago, the Rocky Flats Plant drilled approximately 30 borings at the present landfill. These borings were checked for methane. None was detected. In addition, during the 1987 drilling and installation of 17 monitor wells, methane was not detected.

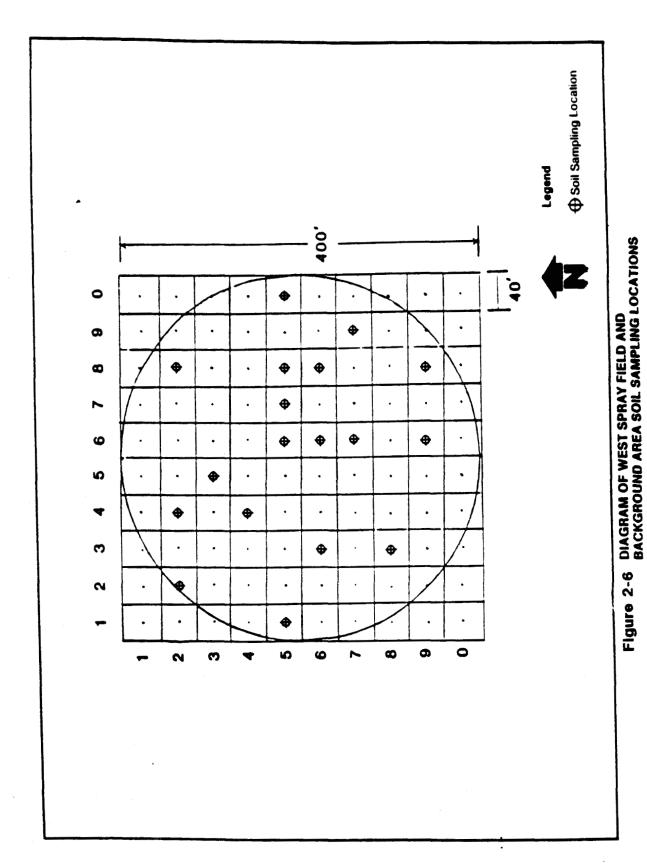
#### 2.2.5 <u>Soil</u>

#### 2.2.5.1 Soil Sampling Location Maps

In April of 1986, soil samples were collected from the West Spray Field. For comparison, background soil samples also were collected from a 400 ft. x 400 ft. non-irrigated area along the Western Plant boundary (Figure 2-5).

Sample locations within the spray area were identified by enclosing the area within a hypothetical 400 ft x 400 ft square subdivided into 100 squares, each 40 x 40 ft (Figure 2-6). The squares were numbered and a random number generator used to identify 18 squares within a circular sampling area. At the center of each of the 18 squares, a surface scrape, a surface core (0-6") and subsurface core (6-12") were collected. The surface scrape and cores were composited to produce three composite surface scrapes, three composite surface soil samples and three composite subsurface soil samples for subsequent analysis for radioactive and nonradioactive parameters.

Nine soil samples also were collected from the background area. Collection methodology was the same as that for the West Spray Field.



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Additional soil samples were collected from test pits in spray application areas at the West Spray Field in 1988 (Figure 2-5).

The 1988 sampling program consisted of digging 12 test pits (WSF-01 through WSF-12) with a backhoe. Seven of the twelve pits were located within the areas impacted by direct application of spray irrigation. Three samples were collected from each pit from various zones within the soil profile. A total of 36 samples were submitted for chemical analyses.

Soil samples are also collected annually both on and off the Rocky Flats Plant site for the analysis of plutonium. In 1987, annual soil sampling included forty soil samples collected in September at radial intervals of approximately 18 degrees and at approximate distances of 1.6 and 3.2 kilometers (1 and 2 miles) from the center of the Plant. Five subsamples were collected from the corners and center of two one-meter squares, which were spaced one meter apart. Each set of ten subsamples was composited for the radiochemical analysis of plutonium. The 1987 sampling locations and plutonium in soil data are displayed in Figure 2-7.

In the past, the Colorado Department of Health and the DOE Environmental Measurements Laboratory have conducted independent surveys of the distribution of plutonium in soil surrounding the Plant. The Jefferson County Health Department also has done some soil sampling.

#### 2.2.5.2 Soil Monitoring Data

Summaries of the analyses of soil samples collected in April of 1986 from the West Spray Field and a background area in the Plant's buffer zone are presented in Tables 2-9 through 2-14. A complete set of the original data sheets can be found in Appendix I-4 (Closure Plan - West Spray Field,) of the Post-Closure Care Permit Application. With the possible exception of some volatile organics, parameters measured in the West Spray Field soil samples showed no significant differences from those seen in the background samples. Toluene, chloroform, acetone, 2-butanone, and methylene chloride were detected at low concentrations in the West Spray Field and/or background samples. However, these compounds are common laboratory reagents and the presence of these substances may be due to laboratory contamination.

The samples collected from the test pits in 1988 were analyzed for hazardous substances list (HSL) volatile organics, total organic carbon, gross alpha, gross beta, plutonium-239, uranium-233,-234, and -238, nitrate, lead, mercury, percent solids, and volatile solids. These parameters were chosen due to the nature

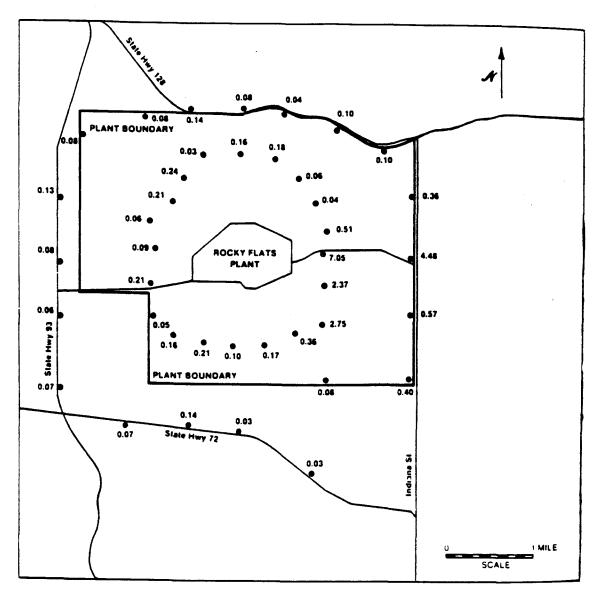


Figure 2-7
1987 Plutonium Concentrations in Soil
(Values in Picocuries Per Gram)

Source: Annual Environmental Monitoring Report, U.S. Department of Energy, Rocky Flats Plant, 1987 [sic].

TABLE 2-9

RANGES OF RADIOACTIVE PARAMETERS IN WEST SPRAY FIELD SOIL SAMPLES\*
(APRIL 1986)

	Surface Scrape Composites	0"-6" Composites	6"-12"Composites
Gross Alpha	40±14 - 55±16	33 <u>±</u> 13 - 44 <u>±</u> 15	20±11 - 31±13
Gross Beta	34 <u>+</u> 6 - 40 <u>+</u> 6	29 <u>+</u> 6 - 34 <u>+</u> 6	29 <u>+</u> 6
Plutonium-239	0.04±0.20 - 0.15±0.21	0.03±0.19 - 0.14±0.21	-0.08±0.09 - 0.04±0.02
Americium-241	0.01±0.06 - 0.02±0.06	-0.02±0.03 - 0.05±0.08	-0.02±0.03
Uranium-233 + Uranium-234	1.0±0.2 - 1.2±0.2	0.73±0.17 - 1.0±0.2	0.59±0.13 - 0.83±0.19
Uranium-238	0.90±0.20 - 1.2±0.20	0.80±0.18 - 1.0±0.2	0.61±0.14 ~ 0.84±0.20
Tritium	0.11±0.23 - 0.39±0.23	-0.09±0.22 - 0.34±0.23	-0.08±0.22 - 0.54±0.24
Air Dry Loss, %	20.7-27.4	19.4-24.0	16.2-67.7

\*Results are expressed in pCi/g dry weight except for tritium, which is given in pCi/ml. Water was extracted from the soil and analyzed for tritium.

#### TABLE 2-10

#### CONCENTRATION RANGES OF INORGANICS AND PHENOLS IN WEST SPRAY FIELD SOIL SAMPLES (APRIL 1986)

#### Concentrations (ma/ka dry weight)

	Surface Scrape Composites	0" - 6" Composites	6" - 12" Composites
Aluminum, total	7570-8330	7390-8760	7010-10,600
Antimony, total	41U-42U	380	37U-41U
Arsenic, total	8.3-9.2	6.40-6.7	6.1-6.8U
Barium, total	1370-1390	1270-1280	1220-1370
Beryllium, total	3.4U-3.5U	3.2U	3.0U-3.4U
Cadmium, total	3.4U-3.5U	3.2U	3.0U-3.4U
Calcium, total	1800-2240	1170-1310	1070-1500
Chromium, total	9.6-11	8.6-12	6.8-14
Cobalt, total	13U-14U,13*		12U-14U
Copper, total	10-11	6.3-11	7.3-9.2
Iron, total	9160-10800	9240-12500	9960-11300
Lead, total	42-63	18-32	14-23
Magnesium, total	1230-1390	1040-1240	922-1310
Manganese, total	295-337	277-326	206-240
Mercury, total	0.1U	0.1U	0.10
Nickel, total	14U-20	13U-19	12U-14U
Potassium, total	1650-1840	1310-1590	1200-1660
Selenium, total	3.4U-3.5U	3.2U	3.0U-3.4U
Silver, total	3.4U-3.5U	3.20	3.0U-3.4U
Sodium, total	68U-75	63U-64U	610-68
Thallium, total	6.80-6.90	6.3U-6.4U	6.1U-6.8U
Tin, total	27U-28U	25U-26U	24U-27U
Vanadium, total	34U-35U	320	30U-34U
Zinc, total	38-52	24-36	26-29
Phenols	0.3U	0.30-0.5	0.20-0.30

U = Compound was analyzed for but not detected above the EPA protocol minimum detection (quantitation) limit (EPA Method No. 3050 (SW 846); EPA CLP 7/85). The number associated with the letter U is the minimum attainable detection limit. Detection limits may vary between samples. In cases in which a substance was not found in any of the samples and in which the detection limit varied, the result is expressed as the range of detection limits for those samples, e.g., 37U-41U; in cases in which the detection limit was the same for all samples, the result is expressed as the common detection limit, e.g., 38U.

\*Cobalt was detected in one sample at the detection limit of 13. It was undetected in two other samples at detection limits of 13 and 14, respectively.

TABLE 2-11

#### CONCENTRATION RANGES OF VOLATILE ORGANICS IN WEST SPRAY FIELD SOIL SAMPLES (APRIL 1986)

### Concentrations (ug/kg)

	Surface Scrape <u>Composites</u>	0" - 6" Composites	6" - 12" Composites
Chloromethane	12U-14U	13U	12U-14U
Bromomethane	12U-14U	130	120-140
Vinyl Chloride	12U-14U	130	12U-14U
Chloroethane	12U-14U	130	12U-14U
Methylene Chloride	29B-36B	33B-70B	29B-33B
Acetone	7U-25B	6U-14B	6U-29
Carbon Disulfide	2BJ-7U	2BJ-6U	2J-6U
1,1-Dichloroethene	6U-7U	6U	6U-7U
1,1-Dichloroethane	6U-7U	6U	6U-7U
Trans-1,2-		00	00-70
Dichloroethene	6U-7U	6U	6U-7U
Chloroform	6U-7U	2J-6U	6U-27
1,2-Dichloroethane	6U-7U	6 U	6U-7U
2-Butanone	12U-14U	130	12U-14U
1,1,1-Trichloro-		150	120-140
ethane	6U-7U	6 <b>U</b>	2J-7U
Carbon Tetra-		00	20 /0
chloride	6U-7U	6U	6U-7U
Vinyl Acetate	12U-13U	130	12U-14U
Bromodichloro-		230	140 140
methane	6U-7U	6U	6U-7U
1,2-Dichloropropane	6U-7U	60	6U-7U
Trans-1,3-Dichloro-			00 70
propene	6U-7U	6U	6U-7U
Trichloroethene	6U-7U	6U	6U-7U
Dibromochloro-			70 70
methane	6U-7U	6U	6U-7U
1,1,2-Trichloro-			00 70
ethan <b>e</b>	6U-7U	6U	2J-70
Benzene	6U-7U	6U	6U-7U
cis-1,3-Dichloro-			00 70
propene	6U-7U	6U	6U-7U
2-Chloroethyl-	•	• •	• • • •
vinylether -	12U-14U	130	12U-14U
Bromoform	6U-7U	6U	6U-7U
4-Methyl-2-			
Pentanone	120-140	130	12U-14U

#### TABLE 2-11

#### CONCENTRATION RANGES OF VOLATILE ORGANICS IN SPRAY FIELD SOIL SAMPLES (APRIL 1986)

(continued)

#### Concentrations (ug/kg)

2-Hexanone Tetrachloroethene 1,1,2,2-Tetra-	Surface Scrape Composites 12U-14U 6U-7U	0" - 6" <u>Composites</u> 13U 6U	6" - 12" <u>Composites</u> 12U-14U 6U-7U
chloroethane	6U-7U	6℧	6U-7U
Toluene	2J-21	6℧− <b>4</b> 3	
Chlorobenzene Ethylbenzene	6U-7U 6U-7U	6U 6U	6U-7 6U-7U 6U-7U
Styrene	6U-7U	6U	6U-7U
Total Xylenes	6U-7U	6U	6U-7U

- U = Compound was analyzed for but not detected above the EPA protocol minimum detection (quantitation) limit (EPA CLP 7/85). The number associated with the letter U is the minimum attainable detection limit. Detection limits may vary between samples. In cases in which a substance was not found in any of the samples and in which the detection limit varied, the result is expressed as the range of detection limits for those samples, e.g., 12U-14U; in cases in which the detection limit was the same for all samples, the result is expressed as the common detection limit, e.g., 13U.
- J = Estimated value. Compound is tentatively identified. Compound was detected below the EPA protocol minimum detection (quantitation) limit.
- B = Analyte was found in blank as well as the sample. The data are considered questionable due to possible blank contamination.

TABLE 2-12

RANGES OF RADIOACTIVE PARAMETERS IN BACKGROUND SOIL SAMPLES

+COUNTING ERROR\*
(APRIL 1986)

	Surface Scrape Composites	0"-6" Composites	6"-12" Composites
Gross Alpha	67 <u>±</u> 17 - 75 <u>±</u> 18	18 <u>+</u> 11 - 46 <u>+</u> 15	18 <u>±</u> 11 - 37 <u>±</u> 14
Gross Beta	50±7 - 56±7	30 <u>+</u> 6 - 40 <u>+</u> 7	28 <u>+</u> 5 - 31 <u>+</u> 6
Plutonium-239	0.02±0.21 - 0.10±0.20	0.01±0.10 - 0.09±0.22	-0.03±0.21 - 0.05±0.21
Americium-241	-0.22±0.03 - 0.00±0.05	0.00±0.08 - 0.28±0.16	-0.02±0.03 - 0.07±0.10
Uranium-233 + Uranium-234	1.1±0.2 - 1.4±0.2	0.77±0.17 - 0.86±0.17	0.66±0.16 - 0.67±0.17
Uranium-238	0.89±0.2 - 1.2±0.2	0.66±0.16 - 0.92±0.18	0.62±0.17 - 0.84±0.17
Tritium	-0.05±0.22 - 0.09±0.23	-0.07±0.22 - 0.20±0.23	-0.08±0.23 - 0.28±0.27
Air Dry Loss, %	21.9-24.8	21.6-22.8	19.8-28.2

Note: Some analytical values are reported as negative numbers. These negatives result when the measured value for the laboratory reagent blank is subtracted from a smaller measured analytical value.

<sup>\*</sup>Results are expressed in pCi/g dry weight except for tritium, which is given in pCi/ml. Water was extracted from the soil and analyzed for tritium.

## TABLE 2-13

# CONCENTRATION RANGES OF INORGANICS AND PHENOLS IN BACKGROUND SOIL SAMPLES (APRIL 1986)

## Concentrations (mg/kg dry weight)

	Surface Scrape Composites	0" - 6" Composites	6" - 12" Composites
Aluminum, total	8770-9140	6540-8190	7200-8640
Antimony, total	40U-41U	38U	37U-38U
Arsenic, total	6.70-6.8	6.30-7	6.10-10
Barium, total	1330-1350	126U-128U	1220-1250
Beryllium, total	3.3U-3.4U	3.2U	3.0U-3.1U
Cadmium, total	3.3U-3.4U	3.20	3.0U-3.1U
Calcium, total		1320-1660	1020-1440
Chromium, total		5.7-11	5.6-10
Cobalt, total		12-13U	120-25
Copper, total	9.6-10	6.9-8.4	6.6-9.9
Iron, total	11000-12300		10200-12400
Lead, total	38-48	17-31	15-19
Magnesium, total		976-1240	883-1030
Manganese, total	272-337	215-274	196-293
Mercury, total	0.1U	0.1U	0.10
Nickel, total	13U-14U	130-13	130-17
Potassium, total	1700-1860	1190-1390	951-1250
Selenium, total	3.3U-3.4U	3.2U	3.00-3.10
Silver, total	3.3U-3.4U	3.2U	3.00-3.10
Sodium, total	67U-217	63U-68	61U-63U
Thallium, total	6.7U-6.8U	6.3U-6.4U	6.10-6.30
Tin, total	270	25U-26U	24U-25U
Vanadium, total	33U-34U	32U	30U-38
Zinc, total	41-49	25-33	20-30
Phenols	0.30	0.3U	0.20-0.5

U = Compound was analyzed for but not detected above the EPA protocol minimum detection (quantitation) limit (EPA Method No. 3050 (SW 846); EPA CLP 7/85). The number associated with the letter U is the minimum attainable detection limit. Detection limits may vary between samples. In cases in which a substance was not found in any of the samples and in which the detection limit varied, the result is expressed as the range of detection limits for those samples, e.g., 40U-41U; in cases in which the detection limit was the same for all samples, the result is expressed as the common detection limit, e.g., 38U.

TABLE 2-14

## CONCENTRATION RANGES OF VOLATILE ORGANICS IN BACKGROUND SOIL SAMPLES (APRIL 1986)

## Concentrations (ug/kg)

	Surface Scrape	0" - 6"	6" - 12"
	Composites	Composites	Composites
Chloromethane	10U	13U	13U-14U
Bromomethane	10U	130	13U-14U
Vinyl Chloride	10U	130	13U-14U
Chloroethane	10	13U	13U-14U
Methylene Chloride	5บ	32B-46B	28B-39B
Acetone	10U-10B	130	71-130
Carbon Disulfide	5U	2BJ-3BJ	6U-3BJ
1,1-Dichloroethene	5บ	6U-7U	6บ-7บ
1,1-Dichloroethane	5บ	6U-7U	6U-7U
Trans-1,2-			
Trichloroethene	5 <b>U</b>	6U-7U	6U-7U
Chloroform	5U	6U-7U	6U-7U
1,2-Dichloroethane	5U	6U-7U	6U-7U
2-Butanone	1 <b>0</b> U	13U-20	26-61
1,1,1-Trichloro-			
ethane	5บ	6U-7U	6U-7U
Carbon Tetra-			
chloride	5บ	6U-7U	6U-7U
Vinyl Acetate	10U	130	13U-14U
Bromodichloro-			
methane	5U	6U-7U	6U-7U
1,2-Dichloropropane	5ช	6U-7U	6U-7U
Trans-1,3-Dichloro-			
propene	5U	6U-7U	6U-7U
Trichloroethene	5 U	6U-7U	6U-7U
Dibromochloro-			
methane	5ช	6U-7U	6U-7U
1,1,2-Trichloro-			
ethane	5U	6U-7U	6U-7U
Benzene	5ช	6U-7U	6U-7U
cis-1,3-Dichloro-			
propene	5บ	6U-7U	6U-7U
2-Chloroethyl-			
vinylether	100	130	13U-14U
Bromoform	5บ	6U-7U	6U-7U
4-Methyl-2-		_	
Pentanone	10U	13U	13U-14U

#### TABLE 2-14

## CONCENTRATION RANGES OF VOLATILE ORGANICS IN BACKGROUND SOIL SAMPLES (APRIL 1986)

(continued)

## Concentrations (ug/kg)

2-Hexanone	Surface Scrape <u>Composites</u> 10U	0" - 6" <u>Composites</u> 13U	6" - 12" <u>Composites</u> 13U-14U
Tetrachloroethene	5ช	6U-7U	6U-7U
1,1,2,2-Tetra-			
chloroethane	5ช	6U-7U	6U-7U
Toluene	1 <b>J</b> B	6U-7U	3J-6U
Chlorobenzene	5ช	6U-7U	6U-7U
Ethylbenzene	5บ	6U-7U	6U-7U
Styrene	5บ	6U-7U	6U-7U
Total Xylenes	5U	6U-7U	6U-7U

- U = Compound was analyzed for but not detected above the EPA protocol minimum detection (quantitation) limit (EPA CLP 7/85). The number associated with the letter U is the minimum attainable detection limit. Detection limits may vary between samples. In cases in which a substance was not found in any of the samples and in which the detection limit varied, the result is expressed as the range of detection limits for those samples, e.g., 13U-41U; in cases in which the detection limit was the same for all samples, the result is expressed as the common detection limit, e.g., 10U.
- J = Estimated value. Compound is tentatively identified. Compound was detected below the EPA protocol minimum detection (quantitation) limit.
- B = Analyte was found in blank as well as the sample. The data are considered questionable due to possible blank contamination.

of the operations at the Rocky Flats facility and the presence of certain analytes in the applied liquids and West Spray Field soils.

Examination of the soil analytes indicates that the concentrations of nitrate, mercury, and plutonium are above estimated background concentrations in the West Spray Field soils. Except for probable laboratory contamination of the samples, volatile organic compounds (VOCs) were not detected in the 1988 test pit soil samples. Analytical results for each sample are presented in Appendix 4 of Appendix I-4.

The 1985 plutonium data from on- and off-site soil sampling by the Plant are summarized in Attachment 10 and also may be found displayed in Figure 2-7. In general, the plutonium concentrations measured in the soil samples collected in the vicinity of the three subject units are at or near background levels (0.01-0.05 pCi/g). All measurements are below the proposed EPA screening level for transuranic contaminants in soil (approximately 16 pCi/g, assuming a soil density of 1.6 g/cc). The EPA has proposed this screening level as a level below which remedial action would not be expected (U.S. EPA, 1977).

There were no current plutonium in soils data available from government agencies. CDH has not sampled for plutonium since 1980.

## 2.3 <u>Transportation Information</u>

## 2.3.1 <u>Waste Vehicles and Containers</u>

The wastes deposited in the solar evaporation ponds, present landfill, and West Spray Field have been generated at the Rocky Flats Plant. A 20 cubic yard trash compactor truck and a dumpster truck (approximately 6-10 cubic yard capacity) transport wastes to the landfill. The trash compactor makes two trips per day, the dumpster truck four or five trips. In the past, liquid wastes were conveyed to the solar ponds by pipeline and by truck. The water which was applied to the West Spray Field was pumped to the field via an above-ground pipeline.

Until September 1986, solidified sludge/sediments from the solar ponds were transported off the Rocky Flats Plant site. These were transported to a DOE-approved disposal site. At present, these solidified sludges/sediments are stored at Rocky Flats. Details of the methods that are being used to remove sludge/sediments during closure are described in Appendix I-1 (Closure Plan - Solar Evaporation Ponds, "Sludges and Sediments") of the Part B Post-Closure Care Permit Application. Wastes associated with the present landfill and West Spray Field have never been transported off the Plant site.

#### 2.3.2 Transport Routes

Traffic patterns into and out of the Rocky Flats Plant site are described in Section B ("Traffic Information") of the December 1987 Part B Permit Application.

## 2.3.3 Procedures for the Clean-up of Leaks/Spills

Procedures for the clean-up of leaks and spills may be found in Section G (Contingency Plan) of the Part B Post-Closure Care Permit Application.

## 2.4 <u>Management Practices Information</u>

There are no known or suspected worker illnesses, injuries, or accidents that have occurred in relation to the operation of the solar evaporation ponds, present landfill, or West Spray Field.

#### 2.5 Release Information

## 2.5.1 Nature and Magnitude of Known Releases

The release of nitrates from the solar ponds to the groundwater is known to have occurred. Details regarding the nature and extent of the release may be found in Section E of the Part B Permit Application and the Solar Evaporation Pond Closure Plan (July 1, 1988). Some soil contamination is presumed. The magnitude and extent of the soil contamination in the vicinity of the solar ponds is discussed in Appendix 6 of the Appendix I-2 (Closure Plan - Solar Evaporation Ponds).

The release of nitrates from the West Spray Field into McKay Ditch was previously mentioned in Section 2.1.6 of this report. Because of heavy snowfall, surface run-off from the water that was sprayed between the period of October 22 and 26, 1984 flowed into McKay Ditch, bypassing the required discharge locations (001, 002, or 004). The run-off entered the Walnut Creek drainage. Table 2-15 lists the nitrate (as N) concentrations measured at the sampling station located on Walnut Creek at Indiana Street on the days on which release occurred and the several days following (Rockwell International, 1984). Nitrates reached a maximum concentration of 11.7 mg/l during the release period, but rapidly fell to 1.3 mg/l within a few days. The nitrate levels did not exceed the limit allowed through NPDES designated outfalls.

There is some evidence that nitrates are possibly being released to the groundwater from the West Spray Field. The results of the analysis of samples collected in August 1986 from monitoring wells located in the vicinity of the West Spray Field showed an

TABLE 2-15

NITRATE CONCENTRATIONS IN WALNUT CREEK (AT INDIANA STREET)
FOLLOWING RELEASE FROM THE WEST SPRAY FIELD

Date	$NO_3$ as $N(mg/1)$
10/22/84	3.4
10/23/84	2.5
10/24/84	4.7
10/25/84	11.7
10/26/84	8.5
10/27/84	4.9
10/30/84	3.0
10/31/84	2.6
11/1/84	2.1
11/2/84	1.6
11/5/84	1.3

elevated level of nitrates (74.7 mg/l) in downgradient well no. 3-82 and in a second well (well no. 5-82) that may also be down-The nitrate levels in two upgradient wells were <5 Samples collected in October 1985 also indicated nitrate mg/1. levels in well nos. 3-82 and 5-82 (15.3 and 4.8 mg/l, respectively) that were above the background level (<1 mg/l) measured in upgradient well no. 8-81. However, in the 1982 survey, the sample from upgradient well no. 10-81 also was reported to contain a slightly elevated nitrate level (7.7 mg/l). It is possible that the elevated nitrate levels measured in samples from the upand/or downgradient monitoring wells in the vicinity of the West Spray Field samples may be due, at least in part, to a source(s) other than the West Spray Field. Results of the 1988 soil sampling effort indicate that the concentrations of nitrate, mercury, and plutonium are above estimated background concentrain the West Spray Field soils. Additional wells proposed in the West Spray Field Characterization Report will better define the hydrologic and geologic conditions which influence the potential transport of contaminants from the West Spray Field In accordance with 40 CFR 264.99, the proposed monitoring program at the West Spray Field will further evaluate the groundwater quality, and will produce information needed to design a groundwater remediation program, if needed. For the sake of perspective, it may be noted that the EPA drinking water standard for nitrates is 10 mg/l (U.S. EPA, 1976).

Based on the available monitoring data, these are the only known releases of materials from the Plant that have been specific to the solar ponds, the present landfill, or the West Spray Field. There have been no known releases to air, including subsurface gas release, from these units.

## 2.5.2 <u>Corrective Actions</u>

To correct the leakage from the solar ponds, the ponds were resealed and trenches with sump pumps were constructed to intercept the groundwater. This system was replaced with a more extensive french drain system in the early 1970s. Intercepted groundwater is returned to Pond 207-B. Details of the collection system are provided in Section B (<u>Facility Description</u>, "Description of the Solar Evaporation Ponds") of the Post-Closure Care Permit Application.

To prevent run-off from the West Spray Field from entering McKay Ditch, interceptor ditches were constructed. Spray irrigation was no longer performed during and after periods of heavy rainfall or snowfall when the spray field was still active. Spray irrigation was discontinued in October 1985.

No actions have been taken to prevent the seepage of nitrates from the spray field to the groundwater. However, because the spray field has ceased operation, the potential for groundwater

contamination is limited to degradation by the residual nitrates in the soil.

## 2.5.3 <u>Impacts of Releases</u>

There have been no known public health impacts as a result of the releases of nitrates or other contaminants from the solar ponds, West Spray Field, or the present landfill. Food chain contamination would not be anticipated. Substantial dilution of the nitrates would be expected before they reached any local sources of irrigation water. The nearest known irrigation well (well no. 27) is located approximately 2.5 miles from the solar ponds (see Table 2-4, Figure 2-1). Standley Lake, which receives drainage from Rocky Flats and is a source of irrigation water, is located approximately four miles from the Plant perimeter.

Wells 6-86, 5-86, 11-86, 38-86, 39-86, 67-86, 66-86, 4-86, 3-86, 2-86, and 1-86 monitor groundwater downgradient of the regulated units and all other solid waste management units, all of which currently indicate no release of contaminants from any units and these points. Based on these wells, no public health impacts have occurred.

#### SECTION 3.0

#### EXPOSURE POTENTIAL OF THE UNITS

The potential for exposure to contaminants from the solar ponds, present landfill, and West Spray Field is affected by hydrologic and meteorologic conditions that are common to the Rocky Flats Plant as a whole and by factors that are specific to each unit. The following subsections address potential exposure pathways. In each subsection, the site conditions which similarly affect the potential for exposure from all three units will first be addressed. Any factors which may specifically influence the potential for exposure to substances from individual units will then be discussed.

## 3.1 <u>Potential for Human Exposure Via the Groundwater</u> Pathway

#### 3.1.1 <u>General Considerations</u>

Groundwater flow beneath the Plant is in two hydraulically connected systems, the shallow Rocky Flats alluvium and valley fill materials, and the deeper Arapahoe Formation. Flow is generally toward the east.

The alluvium thins to the east of the Plant (see Section E of the Part B Permit Application for a diagram of the surficial geology) where the alluvial system discharges at the surface. Although the alluvial system recharges the Arapahoe Formation, the dominant groundwater flow beneath the Plant is within the shallow system. Thus it would be expected that any groundwater contamination that may be present beneath the Plant would impact primarily upon downgradient surface waters. For a discussion of exposure potential through surface water use, see Section 3.2.

Groundwater flow in the Plant area is relatively slow. Although surficial materials are highly permeable, the annual net precipitation is estimated to be minus 83.4 cm, resulting in low recharge. Groundwater velocities are also relatively low. Horizontal groundwater flow velocities for the Rocky Flats alluvium in the Present Landfill, West Spray Field, and Solar Ponds areas were calculated to be 0.03-0.24 ft/day, 0.09 ft/day, and 9.9 x  $10^{-3}$  ft/day, respectively. Within the sandstones of the Arapahoe Formation, the flows were calculated to be  $1.1 \times 10^{-4}$  ft/day for the landfill area, and  $4.4 \times 10^{-4}$  to  $1.3 \times 10^{-3}$  ft/day in the Solar Ponds area. Finally, the weathered claystones of the Arapahoe Formation have an estimated horizontal flow velocity ranging from  $1.2 \times 10^{-7}$  to  $1.86 \times 10^{-3}$  ft/day. A detailed discussion of groundwater flow directions and rates in the uppermost aquifer for each of the units can be found in Section E of the Post-Closure Care Permit Application.

There are no on-site water supply wells located in the shallow aquifer to the east of the Plant. The nearest downgradient wells (see Section 2.2.1.2) are located approximately 2.4 miles northeast of the solar ponds (see Figure 2-1 in Attachment 3, wells no. 1 and 8) near Great Western Reservoir. Well no. 1, a domestic well, is believed to be located in the Arapahoe Formation and/or Fox Hills-Laramie Aquifer. Well no. 8 is a municipal well. The aquifer(s) in which it is completed is unknown.

There were approximately 60 groundwater monitoring wells installed on site from 1960 to 1982. The location of these wells may be found in Figure 3-1. The monitoring wells are sampled four times a year. Samples are analyzed for inorganics, organics, radioactivity, and other water quality parameters. Groundwater monitoring data are presented in Section E of the Part B Permit Application. Seventy (70) additional on-site monitoring wells were installed in 1986 (Rockwell International, 1986c). In 1987, sixty seven (67) groundwater monitoring wells were installed at the facility. This extensive monitoring well network was designed to detect any hazardous contaminants in the groundwater. Appropriate corrective actions could then be taken, if needed, before human exposure to these contaminants could occur.

Due to low groundwater flow rates, the distance to the nearest downgradient withdrawal wells, and the monitoring program at the Rocky Flats Plant, it is unlikely that any significant exposure to contaminants would occur if contaminants were released to the groundwater.

The Colorado Department of Health has sampled five wells downgradient of the Rocky Flats Plant in the vicinity of Standley Lake. Three of the wells are located in Section 19 and two are located in Section 18. The wells were analyzed for EPA priority pollutant volatile organic compounds (VOCs). No VOCs were detected (personal communication, Fred Dowsett, CDH, October 10, 1986).

## 3.1.2 <u>Unit-Specific Factors</u>

#### 3.1.2.1 <u>Solar Evaporation Ponds</u>

Several features decrease the potential for groundwater contamination by the solar ponds when they are active. Groundwater leachate from the solar ponds is collected by an interceptor trench system located north of the ponds. The collected leachate is pumped back to Pond 207-B North. Details of the solar pond

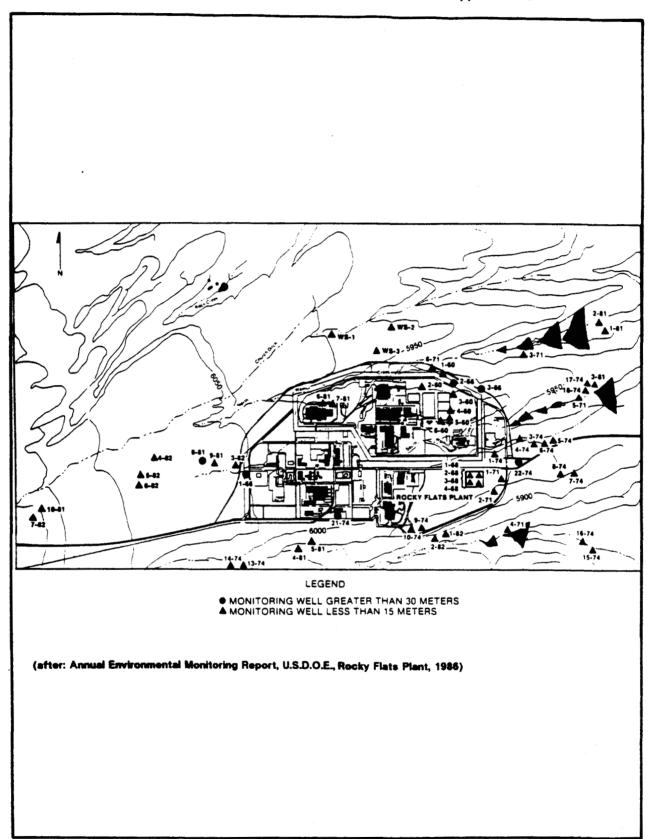


Figure 3-1

LOCATIONS OF MONITORING WELLS INSTALLED DURING 1960-1962
AT ROCKY FLATS PLANT

leachate collection system are described in the Closure Plan for the Solar Ponds (Appendix I-2 of the Post-Closure Care Permit Application).

After closure, the potential for groundwater contamination by the solar ponds will be limited to degradation caused by any residual contamination that may be present in the surrounding soil. After removal of the pond contents and liners, soil samples will be collected for analysis to ensure that no residual contamination remains. If the soil is found to contain unacceptable levels of contaminants, soil will be removed or treated. In addition, if contaminant levels in the groundwater are sufficiently high, the groundwater will be collected and treated. Twenty-eight wells were installed to assess the nature and extent of groundwater contamination from the solar ponds. A diagram of the locations of the new wells can be found in Appendix I-2 (Closure Plan -Solar Evaporation Ponds) of the Post-Closure Care Permit Applica-In Post-Closure Care, no contaminant release should occur. A monitoring program will ensure this.

## 3.1.2.2 Present Landfill

The potential for exposure via the groundwater to contaminants originating in the landfill is decreased by the presence of underlying claystone bedrock. In addition, drains collect groundwater from the perimeter of the landfill and divert it into a holding pond. Water from the holding pond is spray evaporated onto land adjacent to the pond. Water samples from the holding pond are collected monthly and analyzed for a series of organic, inorganic, and radioactive parameters. The groundwater and leachate collection system associated with the landfill is illustrated and discussed in Appendix I-3 (Closure Plan - Present Landfill).

There are 17 existing monitoring wells in the vicinity of the landfill. Two of the wells evaluate conditions upgradient of the landfill, and the remaining wells monitor downgradient and adjacent to the landfill. Well locations are presented in Appendix I
3 (Closure Plan - Present Landfill) of the Post-Closure Care Permit Application.

## 3.1.2.3 West Spray Field

Since the spray irrigation field is no longer active, the potential for groundwater contamination is dependent on the levels of contaminants remaining in the soil. There were no levels of inorganics and radioactive parameters found above background levels in the soil samples collected from the West Spray Field in April 1986 (see Tables 2-9, 2-10, 2-11, 2-13). However, elevated levels of nitrates were measured in samples from monitoring wells located downgradient of the West Spray Field (see Section 2-5). Although very low levels (up to 43 ppb) of a few organics were

reported in soil samples collected in April 1986, the presence of these compounds is questionable, as similar levels of a few organics were also found in background samples from non-irrigated soil (see Tables 2-11 and 2-14).

Eight groundwater monitoring wells were installed in the West Spray Field area between 1981 and 1982. Six new monitoring wells were installed in the vicinity of the West Spray Field as part of the closure investigation. Two of the wells are located to evaluate upgradient conditions, two to evaluate downgradient conditions, and two to evaluate flow toward Woman Creek and North Walnut Creek.

## 3.2 <u>Potential For Human Exposure via the Surface Water</u> <u>Pathway</u>

## 3.2.1 <u>General Considerations</u>

Surface water run-off at the Rocky Flats Plant is from west to east. Run-off from the Plant ultimately drains into either Walnut Creek to the center and north or into Woman Creek to the south. The flow of both creeks is intermittent. Holding/monitoring ponds are located in both drainages (see Figure 2-2). Walnut Creek flows into Great Western Reservoir approximately 1.7 miles from the eastern Plant perimeter. Western Reservoir supplies water for approximately 12,000-13,000 residents in the City of Broomfield. It has no recreational uses. Woman Creek enters Standley Lake approximately four miles from the Plant perimeter. Standley Lake supplies water to approximately 150,000 inhabitants in the cities of Westminster, Northglenn, and Thornton. In addition to being used as a drinking water supply, Standley Lake is used as a source of irrigation water and for boating and fishing. If contamination of Standley Lake were to occur, human exposure could potentially occur via the ingestion of drinking water, fish, and/or crops.

The potential for exposure via surface water to hazardous levels of contaminants from the Rocky Flats Plant is very low. Surface water run-off from the site is collected in a series of control ponds (see Figure 2-2 and Section B of the Part B Permit Application for diagrams of the holding pond system). Water is released from these ponds only after samples are analyzed and found to be within guidelines. The discharges are monitored for compliance with an EPA NPDES permit (NPDES Permit CO-00013333, 1984) and with appropriate Colorado Department of Health standards (Colorado Department of Health, 1981). Surface water samples are analyzed for radioactive parameters, nitrate as N, and suspended solids. Any low level contamination that might be present in the discharges would be expected to be diluted as a result of precipitation, run-off, inflow from intermittent tributaries, and possibly groundwater discharge, as the creeks flow toward Standley Lake and Great Western Reservoir. Further contaminant

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dilution will occur as the creeks enter these receptors. It is estimated by the Broomfield and Westminster Departments of Public Works that drainage from the Rocky Flats area comprises approximately 2-3 percent of the water in the lake and reservoir (personal communications: Gip Wilson, City of Broomfield Dept. of Public Works; Dave Kaunisto, City of Westminster Dept. of Public Works). Great Western Reservoir and Standley Lake are monitored for radioactivity by the Rocky Flats Plant; the City of Broomfield also monitors radioactivity in Great Western Reservoir.

Three flood control dams are located at the Rocky Flats Plant site. They are situated on the North (Pond A-4) and South (Pond B-5) Branches of Walnut Creek and on Woman Creek (Pond C-2) (See Figure 2-2). Water in Ponds A-4, B-5, and C-2 is sampled and analyzed in accordance with the Plant NPDES permit prior to discharge. The dams are designed to retain upstream surface water and all site run-off water predicted for a 100-year storm. The dam system minimizes, for the Plant as a whole, the likelihood of contaminant release occurring via surface waters under severe storm conditions.

If a release from the Plant should reach Great Western Reservoir, the City of Broomfield has contingency plans which switch the Broomfield Service Area over to the Denver water system, e.g., if gross alpha or gross beta exceed  $50 \times 10^{-9} \, \text{uCi/ml}$ . The Rocky Flats Plant provided funding to develop this alternate water supply program.

#### 3.2.2 Unit-Specific Factors

## 3.2.2.1 Solar Evaporation Ponds

After closure, a soil cap will be placed over the solar pond area if hazardous waste remains. The cap will be covered by vegetation or a gravel surface. Details of these procedures may be found in Appendix I-2 (Closure Plan - Solar Evaporation Ponds) of the Post-Closure Plan Permit Application. These procedures should minimize the potential for run-off of any contamination that might remain in unexcavated soil.

## 3.2.2.2 Present Landfill

The final cover design for the Present Landfill will promote surface runoff and reduce ponding and surface water infiltration. Details of these procedures may be found in Appendix I-3 (Closure Pond - Present Landfill) of the Post-Closure Plan Permit application. Final cover vegetation will provide erosion protection from surface runoff.

#### 3.2.2.3 West Spray Field

Under normal precipitation conditions, there is little run-off from the West Spray Field. Diversion trenches prevent run-off from reaching McKay Ditch. The area is very flat and the natural vegetation helps in preventing soil erosion. There are no indications of erosion on the field. [Appendix I-4 (Closure Plan - West Spray Field] of the Post-Closure Plan Permit Application.

## 3.3 Potential for Human Exposure via the Air Pathway

## 3.3.1 <u>General Consideration</u>

The Rocky Flats Plant is located in a sparsely populated area. There are no residents within a 2-mile radius of the Plant, due to the presence of a buffer zone. Approximately 1,585 individuals live within a two to four mile radius of the Plant. Population is densest to the southeast of the Plant. Since winds at the Plant are predominantly from the northwest, these residents are most likely to be the maximally exposed individuals if regular air releases were to occur. A wind rose for the Plant may be found in Section B of the Part B Post-Closure Care Permit Application.

## 3.3.2 Unit-Specific Factors

#### 3.3.2.1 <u>Solar Evaporation Ponds</u>

Prior to closure, the wastes contained in the solar ponds would not be expected to be released to the air. There were no volatile organics unequivocally identified in aqueous samples collected from the ponds in the spring of 1986. Although the analysis was based on EPA protocol (EPA, CLP/85) the presence of acetone at 4680 ug/kg in one of the sediment samples is questionable. Acetone is a common laboratory contaminant and was present in a blank as well as a sample (see Table 2-3). Nonvolatile wastes that remain in the sludge/sediments after evaporation are solidified and disposed of off-site, decreasing the potential for the generation of contaminated airborne particulates.

Depending on the nature and magnitude of the soil contamination beneath and surrounding the ponds, it is possible that there may be some contaminant release to the air during closure activities. The analysis of soil samples will be performed as part of the closure plan and air emission controls will be established as appropriate. It is possible that after the contents and linings of the pond are removed, release could potentially occur from the underlying soils through the generation of fugitive dusts and/or the vaporization of volatiles. Additional release might occur through these routes if the soils have to be excavated. A health

and safety program will be designed and implemented to reduce or eliminate inhalation exposure to workers during closure of the Solar Evaporation Ponds and will be designed to reduce or eliminate off-site exposure.

## 3.3.2.2 Present Landfill

The release of contaminants to the air from the landfill is minimized by the placement of a daily cover of clean soil over the waste materials. A site specific safety plan will be designed for the Present Landfill to reduce or eliminate inhalation exposure to workers during necessary remedial action and associated activities.

## 3.3.2.3 West Spray Field

Releases to the air would not be expected from the West Spray Field. The potential for the generation of fugitive dusts is decreased by the presence of native vegetation (largely Buffalo grass). During the time period that irrigation spraying occurred, air samplers located at the west perimeter fence were being continuously monitored as part of the Rocky Flats Plant air sampling program. If values above background of radionuclides were detected, the procedures for irrigation spraying would have been altered appropriately. No other air monitoring was conducted during the past spray irrigation practices. The presence of volatiles in the soil samples collected from the West Spray Field during April 1986 is questionable (see Table 2-11) since they were also present in laboratory blanks and/or are common laboratory contaminants. Even if they are present at the reported ppb levels, the concentrations (up to 43 ug/kg) are too low to pose an inhalation hazard. For the sake of perspective, it may be noted that Threshold Limit Values (TLVs) for these compounds are in the 100-750 ppm range (ACGIH, 1985). A site specific health and safety plan will be designed for the West Spray Field to reduce or eliminate inhalation exposure to workers, based upon necessary remedial actions and other activities.

## 3.4 <u>Potential for Human Exposure from Subsurface Gas</u> Release

## 3.4.1 General Considerations

There are no known factors associated with the Plant as a whole that might influence the accumulation and/or release of subsurface gas from the units.

## 3.4.2 <u>Unit-Specific Factors</u>

## 3.4.2.1 <u>Solar Evaporation Ponds</u>

When the ponds are active, subsurface gas would not be expected to accumulate to any significant extent, because the impoundments have a large surface area that is open to the atmosphere. No gas is expected to be generated after closure of the unit. During closure, the contents of the solar ponds and, if necessary, contaminated soil will be removed.

#### 3.4.2.2 Present Landfill

The landfill is situated in an open area north of the Plant buildings, away from potentially trapping structures. Its location lessens the potential for any significant exposure through gas release.

There are no systems to control subsurface gas production at the landfill. An investigation during the closure proceedings will determine if a gas collection system needs to be installed.

## 3.4.2.3 West Spray Field

Subsurface gas production would not be anticipated at the West Spray Field. All wastes disposed of in the area were applied to the exposed surface. No cover has been added to the spray field.

#### 3.5 Potential for Human Exposure from Releases to Soil

## 3.5.1 General Considerations

Most of the potential for exposure to contaminants that may be or have been released directly to soil from the three subject units is through the inhalation of dusts or vapors, indirectly through the use of surface waters contaminated by soil via run-off, and/or indirectly by the ingestion of groundwater contaminated by soil. The potential for exposure via the groundwater, surface water, and air pathways has been discussed in sections 3.1, 3.2, and 3.3.

Because regional groundwater and surface water are used for irrigation, the potential exists for soil and food chain contamination. However, it is expected that substantial dilution or attrition (e.g., by immobilization via sorption, volatilization) of contaminants would occur by the time they reached irrigation sources. The nearest known well that is used for irrigation (well no. 27) is located approximately 2.5 miles from the solar ponds. Standley Lake, a source of irrigation water, is situated approximately 4 miles from the Plant perimeter. There are no food crops grown on or in the vicinity of the subject units.

Section 3.5.2 addresses the potential for exposure through direct contact with contaminated soil. In general, direct skin contact

with contaminated soil is not usually an exposure route of concern, particularly if contact is brief and/or infrequent. Contaminants often bind to soil constituents and/or are present in a form that cannot readily penetrate unbroken skin.

## 3.5.2 <u>Unit-Specific Factors</u>

#### 3.5.2.1 Solar Evaporation Ponds

Since releases from the solar ponds to the groundwater are known to have occurred, it is assumed that the soil in the vicinity of the ponds contains some contamination. Exposure to contaminants via direct soil contact may potentially occur during the closure of the ponds. The soil beneath and surrounding the ponds will become exposed after the contents and linings of the ponds are removed. Additional potential for exposure is possible if soil excavation is necessary.

Direct contact with contaminated soil is not expected to be an exposure route of concern. Any potential for contact will be limited to workers involved with the closure of the unit, and appropriate protective clothing will be required. The solar ponds are located within a secured area of the Plant and are accessible only by authorized personnel. The Plant is under tight security and is inaccessible to unauthorized members of the public. The security system at the Plant is described in Section F (Procedures to Prevent Hazards, "Security Procedures and Equipment") of the Part B Post-Closure Care Permit Application.

## 3.5.2.2 Present Landfill

The landfill is located within the Plant boundary and is inaccessible to unauthorized members of the public. Although the area is accessible by Plant personnel, it is unlikely that the general Plant population, with the possible exception of those involved with disposal operations, will have the potential for direct contact with the soils around the unit on a regular basis. A fence will be erected around the landfill to further reduce accessibility.

#### 3.5.2.3 West Spray Field

Based on available soil sampling data, exposure to contaminants through direct contact with soils from the West Spray Field does not pose a concern. The field is within the fenced Plant site security area and is inaccessible to unauthorized members of the public. The vegetative cover minimizes the potential for any direct contact with the soil. The results of analyses of soil samples taken in this area do not appear different from those of samples taken from the background area (see Tables 2-11 through 2-14).

## 3.6 <u>Potential for Human Exposure from Transportation-</u> Related Releases

#### 3.6.1 General Considerations

Procedures for the clean-up of leaks and spills may be found in Section G (Contingency Plan) of the Part B Post-Closure Care Permit Application.

#### 3.6.2 Unit-Specific Factors

## 3.6.2.1 Solar Evaporation Ponds

The potential for exposure to solar pond contaminants via transportation-related releases is minimal. Water from the groundwater interceptor system is transported to the ponds by pipeline. These pipes are inspected periodically for leaks. The sludge from the pond is solidified in cement, packaged according to Department of Transportation (DOT) requirements, and transported in an enclosed trailer to the Nevada Test Site (NTS) for disposal. The solidified sludge may be stored on site prior to shipment. Such storage is in a limited access area with full regulatory controls.

During closure, the sludge will continue to be removed and treated as described. Pond liners and any excavated soils will be stored on site prior to transport to an approved disposal facility.

#### 3.6.2.2 Present Landfill

Landfill wastes remain on site from generation through disposal. Since the landfill is not accessible to the public, risk to the populace of exposure via transportation-related releases is very limited. Most risk of exposure via this pathway is to on-site personnel. On-site exposure potential is minimal for wastes transported in the closed trash compactor trucks.

## 3.6.2.3 West Spray Field

Since the West Spray Field is no longer in operation, there are no risks posed by the transportation of wastes to the field.

## 3.7 <u>Potential for Human Exposure from Worker-Management</u> Practices

## 3.7.1 Worker-Management Practices

There have been no known worker injuries, accidents, or illnesses related to the operation of the solar evaporation ponds, present

landfill, or West Spray Field. Based on the past effectiveness of worker-management practices in preventing releases, it is anticipated that the potential for human exposure to contaminants resulting from worker-management practices is very low.

The Rocky Flats training program for personnel handling radio-active mixed wastes is described in Section H (<u>Personnel Training</u>) of the Part B Post-Closure Care Permit Application; contingency and emergency plans are described in Section G (<u>Contingency Plan</u>).

A "right-to-know" program consistent with OSHA requirements currently is being implemented at the Rocky Flats Plant. This program is designed to ensure that on-site personnel are knowledgeable about the substances with which they work, including their proper storage and handling.

## 3.7.2 <u>Unit-Specific Factors</u>

There are no factors specific to any of the three units which might affect the potential for human exposure from worker-management practices.

#### SECTION 4.0

#### REFERENCES

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United States Environmental Protection Agency (U.S. EPA), 1976: "National Interim Primary Drinking Water Regulations," 41 FR 28404. July 9, 1976.

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SECTION 5.0

ATTACHMENTS

## ATTACHMENT 1

RISK ASSESSMENT OF THE SOLAR EVAPORATION PONDS WHEN RECEIVING RADIOACTIVE WASTES

Source: DOE, 1980. <u>Final Environmental Impact Statement Rocky Flats Plant</u>.

The following text has been reproduced from parts of Section 3 of the <u>Final Environmental Impact Statement Rocky Flats Plant Site</u> (FEIS) (DOE, 1980). It is important to note that the assessment evaluates the risks posed by the solar ponds only while receiving radioactive wastes. It is not applicable to current usage nor to the unit after closure.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Section 3.2.2.3\* Impoundment Failure [excerpt]

The other major source of radioactive material contained in water stored on site is material in the solar evaporation ponds. There are three solar evaporation ponds designated as 207-A, 207-B (divided into three sections), and 207-C. The ponds are asphalt-cement structures constructed near the top edge of a hill having about a 15 degree slope. A landslide of the hill could rupture one or more ponds and release contaminated wastewater into North Walnut Creek. North Walnut Creek ultimately empties into Great Western Reservoir, a water supply for the City of Broomfield.\*\* Typical concentrations of radioactive material in the solar evaporation ponds and the total capacity of the ponds are shown

<sup>\*[</sup>Note: The numbers in the headings and tables in Attachment 1 correspond to those in the FEIS.]

<sup>\*\*</sup> The City of Broomfield has recently (September, 1978) received a grant of \$750,000 for pumping and pipeline revisions to permit the entire city to use water from Denver in case an accident at Rocky Flats should make it necessary to discontinue use of water from Great Western Reservoir.

The actual concentration of material will vary somewhat from pond to pond and will vary even more as a function of time. The mean concentration values, however, are averaged over several years and are responsible for environmental assessments.

If a landslide or other release mechanism were to occur, the solar ponds most likely to rupture would be 207-A and 207-B-north. This result is based on the fact that leakage has occurred from these ponds only, and both are situated at the hill's top edge. This means the soil under these ponds would be wet and more susceptible to sliding than the soil below the other ponds. The operating level of waste solution in these two ponds is 6,936,000 gallons; their overflow capacity is 8,584,000 gallons.

A simple rupture of the solar evaporation ponds would result in no off-site release, since water from these ponds would flow into North Walnut Creek upstream of the A-series holding ponds. The largest of the A-series holding ponds is of sufficient size to hold the capacity of all the solar ponds; consequently, any con-

tamination would be trapped on site. For an environmental release off-site, there would have to be a rupture of the Asseries ponds in addition to the solar evaporation ponds. Such an occurrence would require a major driving force such as an earthquake or tremendous rainfall. If, however, all of the material in the solar evaporation ponds were released to the environment, the total release would be the product of the concentrations in Table 3.2.2-1 and the total capacity, as shown in that table. This release would be about 87,000 uCi of plutonium, 82,000 uCi of americium, and 485,000 uCi of uranium. Of this total release, most would deposit on the ground before reaching Great Western Reservoir. Much of the remainder would become trapped in the Reservoir's sediment or be removed by the City of Broomfield's water-treatment plant prior to the water's being consumed by people.

## TABLE 3.2.2-1

## RADIOACTIVE MATERIAL CONCENTRATIONS IN THE SOLAR EVAPORATION PONDS\*

<u>Material</u>	Mean Concentration <pre>pCi/l)</pre>	Concentration Range (pCi/l)
Americium	1,350	450 - 2,700
Plutonium	1,440	1,200 - 2,000
Uranium	8,000	2,300 - 14,000

<sup>\*</sup>Total capacity of the ponds is  $16 \times 10^6$  gallons (60.6  $\times 10^6$  liters.

This analysis assumes that all of the released material is consumed by Broomfield residents. This clearly overestimates the actual impact. The probability of an off-site release of the total inventory of the solar evaporation ponds is small. (Note that a surface run-off system under construction at Rocky Flats would hold the total site run-off in a design 100-year storm. This system, when implemented, will even further reduce the probability of any off-site release from an impoundment failure).

[Note: Construction of the storm-water containment system has been completed.]

Rainfalls such as the maximum recorded in the Rocky Flats area are not apt to cause the rupture of the many different ponds that would have to be involved. Thus, while an exact probability estimate was not made, it is likely that the probability is much less than  $10^{-2}$  per year.

The new waste-treatment facility, scheduled to be in operation in 1980, will provide total recycle for Rocky Flats process wastewater. The facility will minimize the potential for accidental release of radioactivity to Great Western Reservoir. The water in solar evaporation ponds will be processed and the ponds will be used for storing purified water from the sanitary wastewater recycle plant (see Section 2.7.3.1).

[Note: The relevant part of Section 2.7.3.1 may be found at the end of this section.]

## 3.2.3 <u>Accidental Release Summary</u>

Based on previously presented material, the total, expected, accidental release amounts and the related probabilities are summarized in Table 3.2.3-1. The table gives maximum probable accident releases in addition to maximum credible accident releases as appropriate. Expected annual release amounts are determined by multiplying the release amount by the associated probability of occurrence. All amounts shown as microcuries of plutonium alpha activity were calculated using the plutonium isotopic composition given in Table 2.7.2-2. [Note: not reproduced here.] Besides the plutonium alpha activity, there will also be plutonium-241 beta activity and americium-241 alpha activity. For brevity, these activities are not shown in Table 3.2.3-1, but were included in all environmental dose assessments. The amount of plutonium-241 beta activity is that given in the isotopic composition listing in Table 2.7.2-2, while americium-241 activity was assumed to be equal to 20% of the total plutonium alpha activity. The 20% value is about the maximum amount of americium activity that could build up in any of Rocky Flat's plutonium.

## TABLE 3.2.3-1 [excerpt]

## SUMMARY OF EXPECTED ANNUAL RELEASES OF PLUTONIUM FROM POTENTIAL ACCIDENTS AT ROCKY FLATS

Release Mechanism	Amount of Material Released* (uCi of plutonium alpha activity)	Probability of Release (per year)	Expected Annual Release (uCi/yr of plutonium alpha activity)
Total Impoundment Failure**	87,000 (water)	0.01	870 (water)

<sup>\*</sup> The beta activity of Pu-241 and the alpha activity of Am-241 were also included in the dose calculations, although they are not shown in this summary table.

<sup>\*\*</sup>An impoundment failure would also release 82,000 uCi of americium and 485,000 uCi of uranium.

For the one waterborne release, the americium and uranium activity are shown separately in a footnote. The exact isotopic composition of uranium in the waterborne release is not known, but all uranium alpha-emitting isotopes of concern have nearly identical dose conversion factors; consequently all uranium was treated as uranium-238. Table 3.2.3-2 shows the expected release of fission products from criticalities.

## 3.2.4.2 <u>Impact of Maximum Credible Accident</u> [excerpt]

An assessment more pertinent than the hypothetical risk dose is the assessment of the consequences to downwind persons if an accidental release were actually to occur. The 70-year dose commitment to reference man downwind from each of the maximum credible accidents is presented in Table 3.2.4-2.

The risk of cancer mortalities (plus genetic defects) per man rem of dose (or per rem of dose to one person) is given in Table 3.1.2-10. [Note: Not reproduced here.] When these values are multiplied by the 70-year dose commitments for corresponding organs, the result is the risk of cancer mortality (plus genetic defects) for the individual or population over 70 years. When this multiplication is done for values for the maximum individual for the postulated maximum credible accident (Table 3.2.4-2), the maximum values of risk to an individual of cancer mortality (plus genetic defects) over 70 years are obtained. These values are presented in Table 3.2.4-7. One can generate risk values for the individual at any other distance and direction of interest by the same procedure.

## TABLE 3.2.4-2 [excerpt]

## THE 70-YEAR ORGAN DOSE COMMITMENTS TO REFERENCE MAN DOWNWIND FROM POSTULATED MAXIMUM CREDIBLE ACCIDENTS

Accident Type	Distance Downwind (miles)	70-Yea		e Commitment <u>Bone</u>	(rem) <u>Lungs</u>
Impound- ment Failure	4 1. 5 1.	.4 x 10 <sup>-3</sup>	1.6 x 10 <sup>-1</sup> 1.6 x 10 <sup>-1</sup>	4.0 x 10 <sup>-1</sup> 4.0 x 10 <sup>-1</sup>	1.4 x 10 <sup>-3</sup> 1.4 x 10 <sup>-3</sup>

## TABLE 3.2.4-7 [excerpt]

# RISK OF CANCER MORTALITY OVER 70 YEARS TO THE MAXIMUM REFERENCE MAN FROM POSTULATED MAXIMUM CREDIBLE ACCIDENTAL RELEASES

## Risk of Cancer Mortality over 70 Years Following an Actual Occurrence

Accident Type	Total Body	Liver	Bone	Lungs	Total*	Actual Risk**
Impound- ment Failure	7.0 10-7	3.2 <sub>7</sub> x	2.4 <sub>10</sub> -6 <sup>x</sup>	5.6 <sub>8</sub> x	3.5 10-8	2.5 <sub>6</sub> x

<sup>\*</sup> Does not include the risk of thyroid cancer, which is generally not fatal [and not pertinent for the impoundment failure scenario].

<sup>\*\*</sup>The actual risk is the total risk following an actual occurrence multiplied by the probability of occurrence over 70 years.

## 2.7.3.1 Radioactive Liquid Waste [excerpt]

Wastes less than 100,000 pCi/l total long-lived alpha activity are released to the asphalt-lined solar evaporation ponds where they are stored for future processing. Water from the solar evaporation ponds is now being processed in the new waste treatment facility (Section 2.7.3.3). Sediment from these ponds is handled as contaminated waste. The solar evaporation ponds are currently being cleaned by draining the ponds, partially drying the sludge or mixing it with moisture absorbers, depositing it in appropriate shipping containers, and sending it to an off-site radioactive waste repository. After being cleaned and refined, the solar ponds will be used only for storing cooling tower blowdown water and tertiary treated effluent from the sanitary waste treatment plant. This water will be used as feed water for the reverse osmosis recycling plant. The reverse osmosis product water will be stored in another cleaned and relined solar pond for subsequent use as make-up water for the cooling towers.

# ATTACHMENT 2 AERIAL PHOTOGRAPH OF THE SUBJECT UNITS

## ATTACHMENT 3

## PLATE I

REGISTERED WELLS WITHIN THREE
MILES OF WEST SPRAY FIELD,
PRESENT LANDFILL, SOLAR EVAPORATION PONDS,
AND ORIGINAL PROCESS WASTE LINES
AT ROCKY FLATS PLANT

#### NOTICE

This document (or documents) is oversized for 16mm microfilming, but is available in its entirety on the 35mm fiche card referenced below:

Docume	ent # <u>000</u>	286				
Titled Pre Process	:Registere sent Land Waste L	eli d Wells w fill, Solar incrat Ro	ithin Three Evapora	Miles of tion fond Plant	West Spr s, and O	riginal
	location					

#### ATTACHMENT 10

PLUTONIUM IN SOILS DATA
COLLECTED BY THE ROCKY FLATS PLANT
1987

Source: Rockwell International, 1987 [sic]. Annual Environmental Monitoring Report, U.S. Department of Energy, Rocky Flats Plant.

### Plutonium Concentration<sup>a</sup> in Rocky Flats Area Soil Samples<sup>b</sup> at One and Two Miles From the Plant Center, 1984-1987

	1984	1985	1986	1987
Location	Pu (pCi/g)C	Pu (pCi/g) <sup>c</sup>	Pu (pCi/g) <sup>c</sup>	Pu (pCi/g) <sup>c</sup>
1 010	2.22.2.24	•		
1-018 1-036	0.08 ± 0.02 d	0.15 ± 0.02	$0.15 \pm 0.02$	$0.18 \pm 0.02$
	0.03 ± 0.01	0.08 ± 0.01	$0.10 \pm 0.02$	$0.06 \pm 0.01$
1-054	$0.00 \pm 0.01$	$0.02 \pm 0.01$	$0.04 \pm 0.01$	$0.04 \pm 0.01$
1-072	0.06 ± 0.05	0.32 ± 0.03	0.63 ± 0.06	$0.51 \pm 0.05$
1-090	7.7 ± 0.5	1.0 ± 0.09	7.4 ± 0.62	7.05 ± 0.77
1-108	15.0 ± 0.9	13.0 ± 1.3	15.0 ± 1.4	2.37 ± 0.21
1-126	2.1 ± 0.1	1.9 ± 0.17	1.9 ± 0.18	2.75 ± 0.28
1-144	$0.29 \pm 0.03$	$0.32 \pm 0.03$	$0.27 \pm 0.02$	$0.36 \pm 0.04$
1-162	$0.14 \pm 0.02$	$0.10 \pm 0.01$	0.08 ± 0.01	$0.17 \pm 0.02$
1-180	0.09 ± 0.02	0.06 ± 0.01	$0.06 \pm 0.01$	0.10 ± 0.01
1-198	$0.22 \pm 0.03$	$0.16 \pm 0.02$	$0.16 \pm 0.02$	$0.21 \pm 0.02$
1-216	$0.05 \pm 0.02$	$0.05 \pm 0.01$	$0.10 \pm 0.01$	$0.16 \pm 0.02$
1-234	$0.13 \pm 0.02$	$0.05 \pm 0.01$	$0.04 \pm 0.01$	$0.05 \pm 0.01$
1-252	$0.17 \pm 0.02$	$0.14 \pm 0.02$	$0.11 \pm 0.01$	$0.21 \pm 0.03$
1-270	$0.06 \pm 0.02$	$0.07 \pm 0.01$	$0.08 \pm 0.01$	$0.09 \pm 0.01$
1-288	0.04 ± 0.01	$0.05 \pm 0.01$	$0.05 \pm 0.01$	$0.06 \pm 0.01$
1-306	$0.14 \pm 0.02$	$0.09 \pm 0.01$	$0.17 \pm 0.02$	$0.21 \pm 0.03$
1-324	$0.13 \pm 0.02$	$0.15 \pm 0.02$	$0.21 \pm 0.02$	$0.24 \pm 0.03$
1-342	$0.04 \pm 0.01$	$0.02 \pm 0.01$	$0.03 \pm 0.01$	$0.03 \pm 0.01$
1-360	$0.10 \pm 0.02$	$0.11 \pm 0.01$	$0.19 \pm 0.02$	$0.16 \pm 0.02$
2-018	0.00 ± 0.01	0.04 ± 0.01	0.03 ± 0.01	0.04 ± 0.01
2-036	0.02 ± 0.01	0.02 ± 0.01	0.07 ± 0.01	0.10 ± 0.01
2-054	0.02 ± 0.01	0.02 ± 0.01	0.05 ± 0.01	0.10 ± 0.01
2-072	0.40 ± 0.04	0.33 ± 0.03	0.23 ± 0.02	0.36 ± 0.04
2-090	10.0 ± 0.6	2.5 ± 0.25	5.3 ± 0.48	4.48 ± 0.52
2-108	0.46 ± 0.04	0.41 ± 0.04	0.46 ± 0.04	0.57 ± 0.06
2-126	0.14 ± 0.02	0.42 ± 0.04	0.44 ± 0.05	0.40 ± 0.04
2-144	0.02 ± 0.01	0.04 ± 0.01	0.04 ± 0.01	0.08 ± 0.01
2-162	0.00 ± 0.01	0.01 ± 0.00	0.02 ± 0.01	0.03 ± 0.01
2-180	0.02 ± 0.01	0.11 ± 0.01	0.04 ± 0.01	0.03 ± 0.01
2-198	0.05 ± 0.02	0.02 ± 0.01	0.08 ± 0.01	0.14 ± 0.02
2-216	0.04 ± 0.01	0.04 ± 0.01	0.06 ± 0.01	0.07 ± 0.01
2-234	0.04 ± 0.01	0.05 ± 0.01	0.05 ± 0.01	0.07 ± 0.01
2-252	0.09 ± 0.01	0.04 ± 0.01	0.07 ± 0.01	0.06 ± 0.01
2-270	0.04 ± 0.01	0.04 ± 0.01	0.06 ± 0.01	0.08 ± 0.01
2-288	0.01 ± 0.01	0.04 ± 0.01	0.05 ± 0.01	0.13 ± 0.02
2-306	0.00 ± 0.01	0.06 ± 0.01	0.02 ± 0.01	$0.08 \pm 0.01$
2-324	0.08 ± 0.02	0.04 ± 0.01	$0.02 \pm 0.01$	$0.08 \pm 0.01$
2-342	0.13 ± 0.02	$0.13 \pm 0.01$	0.12 ± 0.01	0.14 ± 0.02
2-342	0.02 ± 0.01	0.09 ± 0.01	0.05 ± 0.01	0.08 ± 0.01
4-30U	0.02 1 0.01	0.09 1 0.01	0.00 1 0.01	0.00 2 0.01

a. Not blank corrected.

b. Sampled to a depth of 5 cm.

c. Concentrations are for the fraction of soil measuring less than 2mm in diameter.

d. Error term represents 2 standard deviations.

#### ATTACHMENT 4

#### PLATE II

SURFACE WATER FEATURES WITHIN THREE
MILES OF WEST SPRAY FIELD, PRESENT LANDFILL,
SOLAR EVAPORATION PONDS, AND
ORIGINAL PROCESS WASTE LINES
AT ROCKY FLATS PLANT

#### NOTICE

This document (or documents) is oversized for 16mm microfilming, but is available in its entirety on the 35mm fiche card referenced below:

Titled: Plate II Surface Water Features Within Three Miks of West Spray Field, Present Landfill, Solar Evaporation Ponds, and Original Process Waste Lines at Rocky Flats Plant

Fiche location: A-SW-M10

### Annual Average Concentrations of Chemical and Biological Constituents in Liquid Effluents<sup>a</sup>

Parameter	Number of Analyses	C <sub>min</sub> _	Cmax	Cmean
<del></del>		min	max	mean
Discharge 001 <sup>b</sup>				
pH.SU <sup>c</sup>	3 <b>3</b>	6. <b>6</b>	7.5	-
Nitrate as N, mg/k	33	<0.4	3.2	1.4
Total Suspended Solids, mg/y	33		19.0	8.5
Total Residual Chlorine, mg/v	33	<0.05	0.2	0.1
Total Chromium, mg/v	12	< 0.05	0.1	0.05
Total Phosphorus, mg/v	33	0.6	6.0	1.2
Fecal Coliform, #/100 mg	30	<1	3.5	1.2
Biochemical Oxygen Demand (BOD, ), mg/g	15		20.0	9.0
Discharge 002 <sup>b</sup>				
pH, SU	38	7.0	8.0	~
Nitrate as N. mg/v	38	-	4.2	2.4
Discharge 003 <sup>b</sup>	•		o discharges mad Osmosis Pilot P	
Discharge 004 <sup>b</sup>	During 1987, ther were no discharges made to offsite waters from the Reverse Osmosis Plant.			
Discharge 005 <sup>b</sup>				
pH, SU	21	7.4	8.4	_
Nitrates as N. mg/g	21	0.2	5.1	1.5
Nonvolatile Suspended	-•		J.,	1.5
Solids, mg/g	21	0.0	21	3.7
Discharge 006 <sup>b</sup>				
pH, SU	36	7.0	8.7	_
Nitrates as N. mg/v	36	0.2	3.8	1.4
Nonvolatile Suspended	30	0.5	5.6	1.4
Solids, mg/v	36	0.0	18.0	3.6
Discharge 007b				
pH, SU	15	6.9	8.1	_
Nitrates as N. mg/c	15	0.2	1.3	0.5
Nonvolatile Suspended		(Fran	1.5	<b>0.5</b>
Solids, mg/v	15	0.0	7.0	3.1

a. Examples of NPDES Permit limitations are presented in Table A-1.

b. The Environmental Protection Agency NPDES discharge permit defines the discharge locations as follows:

<sup>001 -</sup> Pond B-3

<sup>002 -</sup> Pond A-3

<sup>003 -</sup> Reverse Osmosis Pilot Plant

<sup>004 -</sup> Reverse Osmosis Plant

<sup>005 -</sup> Pond A-4

<sup>006 -</sup> Pond B-5

<sup>007 -</sup> Pond C-2

c. SU - Standard Units

#### Plutonium, Uranium, and Americium Concentrations in Water at the Rocky Flats Plant

Location	Number of Analyses	Cmin	C <sub>max</sub>	C <sub>mean</sub>	Percent of DCG
		Plutonium Concentration (x	10 <sup>-•</sup> μCi/m <sup>k</sup> ) <sup>a</sup>		
Pond A-4	8	0.00 ± 0.02b	0.04 ± 0.03 <sup>b</sup>	0.01 ± 0.009 °	0.003
Pond B-5	10	$-0.007 \pm 0.03$	$0.04 \pm 0.03$	$0.02 \pm 0.007$	0.007
Pond C-1	48	0.00 ± 0.007	$0.08 \pm 0.01$	$0.02 \pm 0.003$	0.007
Pond C-2	5	$-0.02 \pm 0.03$	$0.05 \pm 0.03$	$0.03 \pm 0.02$	0.01
Walnut Creek at Indiana Street	32	$-0.02 \pm 0.05$	7.1 ± 0.08	$0.02 \pm 0.004$	0.007
		Uranium Concentration (×	10-* μCi/m²) <sup>d</sup>		
Pond A-4	8	5.2 ± 0.5b	25.0 ± 3.0b	11.3 ± 1.2°	2.3
Pond B-5	12	2.7 ± 0.3	$6.5 \pm 0.7$	$4.6 \pm 0.5$	0.9
Pond C-1	48	$0.03 \pm 0.1$	4.3 ± 0.5	$1.3 \pm 0.3$	0.3
Pond C-2	5	3.6 + 0.6	6.9 ± 0.6	$5.4 \pm 0.2$	1.1
Walnut Creek at Indiana Street	32	0.9 • 0.1	13.0 ± 2.0	3.8 ± 0.1	0.8
		Americium Concentration (	× 10- µCi/inu)c		
Pond A-4	8	0.01 ± 0.02b	0.03 ± 0.02b	0.02 ± 0.02°	0.03
Pond B-5	12	$-0.01 \pm 0.02$	$0.04 \pm 0.02$	$0.01 \pm 0.008$	0.02
Pond C-1	48	$-0.002 \pm 0.005$	$0.05 \pm 0.02$	$0.01 \pm 0.002$	0.02
Pond C-2	5	$-0.03 \pm 0.05$	$0.03 \pm 0.02$	$0.01 \pm 0.03$	0.02
Walnut Creek at Indiana Street	32	$-0.02 \pm 0.05$	$2.1 \pm 0.3$	$0.01 \pm 0.01$	0.02

Radiochemically determined as plutonium-239 and -240. The interim standard calculated Derived Concentration Guide (DCG) for plutonium in water available to members of the public is 300 × 10<sup>-9</sup> μCi/mg. (See Appendix A.)

b. Calculated as 1.96 standard deviations of the individual measurement.

c. Calculated as 1.96 standard deviations of the mean.

d. Radiochemically determined as uranium-233, -234, and -238. The interim standard calculated Derived Concentration Guide (DCG) for uranium in water available to members of the public is 500 × 10<sup>-9</sup> μCi/mv. (See Appendix A.)

e. Radiochemically determined as americium-241. The interim standard calculated Derived Concentration Guide (DCG) for americium in water available to members of the public is  $60 \times 10^{-9} \ \mu\text{Ci/mg}$ . (See Appendix A.)

Date: 5 October 1988 Revision No. 1

Appendix I-1

#### Tritium Concentrations in Water at the Rocky Flats Plant

#### Tritium Concentration (× 10<sup>-6</sup> μCi/mε)<sup>2</sup>

Location	Number of Analyses	C <sub>min</sub>	Cmax	Cmcan	Percent of DCG
Pond A-4	21	-700 ± 400b	800 ± 400 <sup>b</sup>	200 ± 90°	0.01
Pond B-5	37	-600 ± 400	1000 ± 400	200 ± 70	0.01
Pond C-1	44	-900 ± 400	800 ± 500	100 ± 60	0.005
Pond C-2	13	-400 ± 400	700 ± 600	300 ± 120	0.02
Walnut Creek at Indiana Street	63	-1000 ± 400	1000 ± 400	400 ± 40	0.02

a. The interim standard calculated Derived Concentration Guide (DCG) for tritium in water available to the members of the public is 2,000,000 × 10<sup>-9</sup> μCi/mv. (See Appendix A.)

b. Calculated as 1.96 standard deviations of the individual measurement.

c. Calculated as 1.96 standard deviations of the mean.

	Number of				Percent of
Locat on	Ansiyses	Cmin	Cmax	Cucan	DCG
Reservoir		Plutoniu	m Concentration (X-10*	μCi/mε) <sup>a</sup>	
Boulder	1	-0.002 ± 0.03 b	-0.002 ± 0.03b	-0.002 ± 0.03°	<0.001
Dillon	i	-0.01 ± 0.02	-0.01 ± 0.02	-0.01 ± 0.02	<0.001
Great Western	12	$-0.002 \pm 0.005$	0.04 ± 0.06	0.007 ± 0.01	0.002
Raiston	1	$-0.001 \pm 0.03$	$-0.001 \pm 0.03$	-0.001 + 0.03	<0.001
South Boulder Diversion Canal	1	0.01 ± 0.03	$0.01 \pm 0.03$	$0.01 \pm 0.03$	0.003
Standicy	12	-0.004 ± 0.002	0.004 ± 0.001	0.004 ± 0.006	0.001
Drinking Water					
Arvada	7	-0.007 ± 0.004 <sup>b</sup>	0.01 ± 0.03 <sup>b</sup>	0.003 ± 0.01°	0.001
Boulder	12	-0.003 ± 0.002	0.03 ± 0.01	$0.004 \pm 0.006$	0.001
Broomtield	12	-0.002 ± 0.002	0.02 ± 0.01	0.004 ± 0.006	0.001
Denver Golden	4	-0.01 ± 0.01	0.02 ± 0.03	0.002 ± 0.02	0.001
Lafayette	7	-0.006 ± 0.01 -0.02 ± 0.01	0.01 ± 0.02	0.002 ± 0.01	0.001
Louisville	4	-0.007 ± 0.01	0.01 ± 0.03 0.00 ± 0.03	-0.001 ± 0.01 -0.005 ± 0.01	<0.001 <0.001
Thornton	4	-0.01 ± 0.01	0.000 ± 0.03	-0.003 ± 0.01	<0.001
Westminster	12	-0.003 ± 0.002	0.02 ± 0.01	0.002 ± 0.002	0.001
Reservoir		Uranius	n Concentration (× 10**	µCl/mx)d	
Boulder	1	0.7 ± 0.1b	0.7 ± 0.1 <sup>b</sup>	0.7 ± 0.1°	0.1
Dillon	i	1.0 ± 0.1	1.0 ± 0.1	1.0 ± 0.1	0.2
Great Western	12	$1.8 \pm 0.2$	4.9 ± 0.5	$2.5 \pm 0.1$	0.5
Rakton	1	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1	0.3
South Boulder Diversion Canal	l	$0.4 \pm 0.1$	$0.4 \pm 0.1$	0.4 ± 0.1	0.1
Standley	12	0.3 ± 0.1	2.7 ± 0.3	1.7 ± 0.1	0.3
Drinking Water					
Arvada	7	$-0.01 \pm 0.02^{b}$	0.6 ± 0.1 b	0.3 ± 0.03°	0.1
Boulder	12	-0.01 ± 0.08	1.2 ± 0.2	0.2 ± 0.03	0.04
Broom field	12 4	0.5 ± 0.1 0.2 ± 0.1	1.7 ± 0.2 1.4 ± 0.2	1.2 ± 0.2 0.7 ± 0.1	0.2 0.1
Denver Golden	4	0.6 ± 0.1	1.8 ± 0.3	1.1 ± 0.2	0.2
Lafayette	4	0.1 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.04
Louisville	4	-0.03 ± 0.1	0.1 ± 0.1	$0.04 \pm 0.05$	0.01
Thornton	4	1.1 ± 0.2	4.6 ± 0.6	3.5 ± 0.2	0.7
Westminster	12	0.01 ± 0.04	1.9 ± 0.2	0.6 ± 0.1	0.1
Reservoir		Americ	rium Concentration (X.)	0- aCi/me)C	
Boulder	1	-0.003 ± 0.2b	-0.003 ± 0.02 <sup>b</sup>	-0.003 + 0.02°	< 0.001
Dillon	1	0.000 ± 0.002	0.000 ± 0.02	$0.000 \pm 0.02$	< 0.001
Great Western	12	-0.01 # 0.01	$0.02 \pm 0.01$	$0.002 \pm 0.003$	0.003
Raiston	i	0.01 ± 0.02	$0.01 \pm 0.02$	$0.01 \pm 0.02$	0.02
South Boulder Diversion Canal	1	0.02 ± 0.02	$0.02 \pm 0.02$	$0.02 \pm 0.02$	0.03
Standley	12	-0.01 ± 0.01	0.01 ± 0.01	0.002 ± 0.002	0.003
Drinking Water					
A rvada	7	-0.01 ±0.02b	0.02 ± 0.02 <sup>b</sup>	0.005 ± 0.004°	0.008
Boulder Broomfield	12 12	-0.003 ± 0.003	0.02 ± 0.01	0.005 ± 0.002	0.008
Denver	4	-0.01 ± 0.01 -0.006 ± 0.02	0.01 ± 0.02 0.02 ± 0.02	0.002 ± 0.002 0.007 ± 0.02	0.003
Golden	4	-0.002 ± 0.02	0.04 ± 0.03	0.007 ± 0.02	0.01 0.03
Lafayette	4	-0.003 ± 0.02	0.007 ± 0.02	0.001 ± 0.02	0.002
Louisville	4	$-0.004 \pm 0.02$	0.04 ± 0.02	0.01 ± 0.02	0.02
Thornton	4	-0.01 ± 0.05	$0.04 \pm 0.02$	$0.01 \pm 0.02$	0.02
Westminster	12	$-0.001 \pm 0.003$	0.06 ± 0.01	0.007 ± 0.003	0.01

a. Radiochemically determined as plutonium-239 and -240. The interim standard calculated Derived Concentration Guide (DCG) for plutonium in water available to members of the public is 300 × 10° µCi/m². (See Appendix A.)

b. Calculated as 1.96 standard deviations of the individual measurements.

c. Calculated as 1.96 standard deviations of the mean.

d. Radiochemically determined as uranium-233, -234, and -238. The interim standard calculated Derived Concentration Guide (DCG) for uranium in water available to members of the public is 500 × 10<sup>-9</sup> μCi/mk. (See Appendix A.)

Radiochemically determined as americium-241. The interim standard calculated Derived Concentration Guide (DCG) for americium in water available to members of the public is 60 × 10<sup>-9</sup> μCi/mg. (See Appendix A.)

#### Tritium Concentrations in Public Water Supplies

Location	Number of Analyses	Cmin	C <sub>max</sub>	C <sub>mean</sub>	Percent of DCG
Reservoir		Tritium Concen	tration (× 10 ° μCi/	mℓ) <sup>a</sup>	
Boulder	1	400 ± 400 <sup>b</sup>	400 ± 400 <sup>b</sup>	400 ± 400°	0.02
Dillon	1	700 ± 400	700 ± 400	700 ± 400	0.04
Great Western	48	$-700 \pm 100$	800 ± 500	100 ± 60	0.005
Rakton	1	200 ± 400	200 ± 400	200 ± 400	0.01
South Boulder Diversion Canal	1	300 ± 400	300 ± 400	300 ± 400	0.02
Standley	48	-300 ± 100	500 ± 600	100 ± 60	0.005
Drinking Water					
Arvada	4	0 ± 400 b	900 ± 500 <sup>b</sup>	400 ± 220°	0.02
Boulder	48	$-700 \pm 100$	900 ± 500	100 ± 60	0.005
Broomfield	48	-600 ± 100	1020 ± 500	100 ± 60	0.005
Denver	4	$-300 \pm 400$	700 ± 500	100 ± 210	0.005
Golden	4	$-300 \pm 400$	0 ± <b>400</b>	$-200 \pm 210$	< 0.001
Lafayette	4	$-200 \pm 200$	700 ± 400	200 ± 210	0.01
Louisville	4	$-100 \pm 200$	500 ± 400	200 ± 210	0.01
Tho.nton	4	100 ± 200	2000 ± 500	700 ± 220	0.04
Westminster	48	-600 ± 100	800 ± 500	100 ± 130	0.005

a. The Derived Concentration Guide (DCG) for tritium in water available to members of the public is 2.000.000 × 10<sup>-9</sup> μCi/m<sup>Q</sup>. The EPA and State of Colorado Primary Drinking Water Regulation limits for tritium are 20.000 × 10<sup>-9</sup> μCi/m<sup>Q</sup>.

b. Calculated as 1.96 standard deviations of the individual measurements.

c. Calculated as 1.96 standard deviations of the mean.

#### ATTACHMENT 5F

# CONCENTRATIONS OF ORGANIC, INORGANIC, AND RADIOACTIVE PARAMETERS IN THE LANDFILL POND EAST (LANDFILL POND NO. 2) 1987

Parameter	Minimum	<u>Maximum</u>
рН	7.9	8.6
COD (mg/l)	50	102
$NO_3$ as $N (mg/1)$	<0.2	<0.2
TDŠ (mg/l)	372	1,082
TS* (mg/1)	390	795
TOC (mg/l)	7.0	31
Conductivity		
(umho/cm)	602	77 <del>9</del>
Phenol (ug/l)	<1.0	6.0
PCBs (ug/l)	<0.4	<50
Sr-90 (pCi/1)	0.0	7.9
Gross alpha (pCi/l)	<del>-</del> 5.0	73 <u>±</u> 33
Gross beta (pCi/l)	-10	55 <u>+</u> 37

\*TS (Total Solids) is the sum of TDS (Total Dissolved Solids) and TSS (Total Suspended Solids).

#### ATTACHMENT 5F

## CONCENTRATIONS OF INORGANIC, RADIOACTIVE, AND ORGANIC PARAMETERS IN THE LANDFILL POND EAST 1987

	si swlf-1	AMPLE DESIGNATI	ON SWLF-3
Inorganics (mg/l)			
21102 July 27			
Chloride	97.0	121.5	123.7
Sulfate	37.6	8.1	8.5
TDS	655	1081	1082
Alkalinity	402	190	195
Nitrate -	<0.20	<0.20	<0.20
Metals (mg/kg)			
Silver	0.0076U	0.0076U	0.00760
Aluminum	0.2324	0.7041	0.5842
Barium	0.2568	0.1884	0.1885
Calcium	64.7146	94.7446	100.4984
Cobalt	0.0220U	0.0220U	0.0220U
Chromium	0.0122	0.0192	0.0168
Copper	0.0063U	0.0072	0.0063U
Iron	0.3705	2.2593	2.3254
Magnesium	33.4648	73.6777	74.5405
Manganese	0.1424	0.3363	0.4216
Molybdenum	0.0220U	0.0220U	0.0220U
Sodium	113.2378	225.8143	216.0188
Nickel	0.0370U	0.03700	0.03700
Strontium	0.5847	1.0469	1.0474
Vanadium	0.0240U	0.0240U	0.0240U
Zinc	0.02000	0.0337	0.0320
Antimony	<0.05	<0.05	<0.05
Arsenic	<0.010	<0.010	<0.010
Cadmium	<0.005	<0.005	<0.005
Lead	<0.005	<0.005	<0.005
Mercury	<0.002	<0.002	<0.002
Potassium Selenium	13	9	10
Selenium Thallium	<0.005	<0.005	<0.005
Cesium	<0.010	<0.010	<0.010
	<0.2	<0.2	<0.2
Beryllium	<0.005	<0.005	<0.005

#### ATTACHMENT 5F

# CONCENTRATIONS OF INORGANIC, RADIOACTIVE, AND ORGANIC PARAMETERS IN THE LANDFILL POND EAST 1987 (CONTINUED)

SAN	IPLE DESIGNATION	ON
SWLF-1	SWLF-2	SWLF-3

#### Radiochemistry (pCi/q)

Uranium-234	0.9 <u>+</u> 1.7	0.0 <u>+</u> 2.0	$(0.0\pm7.9)10-1$
Uranium-235	$(2.2\pm5.8)10-1$	$(1.4\pm6.1)10-1$	1.1 <u>+</u> 1.8
Uranium-238	2.0 <u>+</u> 1.3	2.0 <u>+</u> 1.9	$(0.0\pm5.5)10-1$
Plutonium-239	0.0 <u>+</u> 0.9	(0.0 <u>+</u> 5.6)10-1	$(0.0\pm 9.7)10-1$
Americium-241	0.0 <u>+</u> 1.3	4.4x10+2	2.3x10+3
Tritium	1.4x10+2	4.4x10+2	2.3x10+3
Strontium-90	1.8	1.1	<1.0
Cesium-137	4.0	4.0	<1.0
gross alpha	4 <u>+</u> 9	15 <u>+</u> 3	23 <u>+</u> 11
gross beta	27 <u>+</u> 22	16 <u>+</u> 13	24 <u>+</u> 3

#### Volatile Organics

All volatiles were not detected.

Sample SWLF1 collected from west side of landfill pond. SWLF2 and SWLF3 are water samples from the landfill pond. All three samples were collected on 9/30/87.

#### ATTACHMENT 5G

#### DERIVED CONCENTRATION GUIDES (DCGs)

#### DCGs for Radioactive Parameters in Water Available to Members of the Public (uCi/ml)

Americium (as -241)  $60 \times 10^{-9}$ Plutonium (as -239 and -240)  $300 \times 10^{-9}$ Tritium  $2,000,000 \times 10^{-9}$ Uranium (as -233, -234, -238)  $500 \times 10^{-9}$ 

DCGs for Inhalation of Radioactive Parameters
by Members of the Public (uCi/ml)

DCG

Plutonium (Class W)

20 x 10<sup>-15</sup>

#### ATTACHMENT 6

SURFACE WATER DATA COLLECTED BY GOVERNMENT AGENCIES 1985 AND 1987

#### ATTACHMENT 6A

## SURFACE WATER PARAMETERS MEASURED BY THE ENVIRONMENTAL PROTECTION AGENCY AT DISCHARGE POINT 001 (1987)

Parameter	Number of Analyses	Annual Average Mean	NPDES Allowable <u>Limit</u>
BOD (mg/l)	33	9.0	25
TDS (mg/l) NO <sub>3</sub> as N	NA	NA	45
(mg/l) Total chromium	33	1.4	20
(mg/l) Total phosphorus	12	0.05	0.1
(mg/l) Total residual	33	1.2	12
chlorine (mg/l) Oil and grease	33	0.1	0.5
(visual) Fecal coiliform	NA	их	none
(count/100ml)	30	1.2	400
pH (SU)	33	NA	6.0-9.0

NA - Not available SU - Standard Units

Source: 1987 Annual Monitoring Report

#### ATTACHMENT 6B

## RANGES OF ALPHA AND BETA ACTIVITY IN OFF-SITE SURFACE WATER SAMPLES COLLECTED BY THE CITY OF BROOMFIELD 1985

#### Activity (x 10<sup>-9</sup> uCi/ml)

Location	Alpha	Beta
Walnut Creek (at Indiana St.)	1.0±5-11 <u>+</u> 6	1.0 <u>±</u> 10-18 <u>±</u> 14
Dry Creek Valley Ditch	1.0±3-11±11	1.0±10-14±10
Great Western Reservoir	1.0 <u>±</u> 4-10 <u>+</u> 5	1.0 <u>±</u> 10-16±12
Broomfield <sup>1</sup>	1.0±6-6.6±4	1.0 <u>±</u> 11-14 <u>+</u> 12
Denver <sup>2</sup>	1.0±4-6.7±6	1.0±11-14±10
Co-mingled <sup>3</sup>	1.0±4-9.1±4	1.0±11-15±11

 $<sup>^{1}</sup>$  Results obtained from weekly composite samples of drinking water from the Broomfield Water Treatment Plant.

Source: City of Broomfield, 1985. Radiometric Monitoring Report. Monthly Information Exchange Meeting.

Results obtained from grab samples from the Denver side of Broomfield's distribution system.

<sup>3</sup> Results obtained from grab samples from the co-mingled side of Broomfield's distribution system.

#### ATTACHMENT 6C

RANGES OF ALPHA, BETA, AND TRITIUM ACTIVITY IN ON- AND OFF-SITE SURFACE WATER SAMPLES COLLECTED BY THE COLORADO DEPARTMENT OF HEALTH 1985

Activity (x 10<sup>-9</sup> uCi/ml)

Location	Alpha	Bets	Tritium
Pond A-3	<4-11 <u>+</u> 4	<5-15 <u>±</u> 4	<350-738±197
Pond B-3	<3-12	<5-21	<350~618
Walnut Creek (at Indiana St.)	<3-11	<5-17	<350-1,271
Woman Craek* (at Indiana St.)	<4-<5	<5-5 <u>+</u> 3	<350
Westminater	<3-<4	<5	<350-706
Broomfield	<3~6	<5~10	<350-503
Arvada	<2-5±2	<5	<350
North Table Mountain	<2-3 <u>+</u> 2	<5	<350-446±188
Boulder**	<2-<3	<5	<350
Golden**	<3	<5 <b>-</b> 5 <u>+</u> 3	<350

<sup>\*</sup> Based on 2 samples.

Source: Colorado Department of Health, 1985. Environmental Surveillance Report on the U.S. Department of Energy Rocky Flats Plant. Monthly Information Exchange Meeting. December.

<sup>\*\*</sup> Based on 4 (quarterly) samples.

#### ATTACHMENT 6D

# RANGES OF NATURAL URANIUM AND TOTAL ALPHA CONCENTRATION IN WATER SAMPLES COLLECTED BY THE COLORADO DEPARTMENT OF HEALTH 1985

Sampling <u>Station</u>	Months <u>Sampled</u>	URANIUM (ug/l) (x 10	-9 uCi/ml)	ALPHA (x 10 <sup>-9</sup> uCi/ml)
Pond A-3	Oct., Dec.	<3	<2	<4-11 <u>+</u> 4
Pond B-3	Nov., Dec.	<3	<2	<4
Walnut Creek at Indiana Street	Oct., Nov., Dec.	5.9-11.8	3.9-7.8	<5-10
Broomfield	Nov., Dec.	<3	<2	<4
Westminster	Nov., Dec.	<3	<2	<3
Arvada	Oct., Nov., Dec.	<3	<2	<2-2 <u>+</u> 2
Boulder	Dec.	<3	<2	<2
Golden	Nov.	<3	<2	<3
North Table Mountain	Oct., Nov., Dec.	<3-3.7	<2-2.5	<2

Source: Colorado Department of Health, 1985. <u>Environmental Surveillance Report on the U.S. Department of Energy Rocky Flats Plant. Monthly Information Exchange Meeting, December 1985.</u>

#### ATTACHMENT 7

AIR QUALITY DATA COLLECTED BY THE ROCKY FLATS PLANT 1987

Source: Rockwell International, 1987 [sic]. <u>Annual Environmental Monitoring Report</u>. U.S. <u>Department of Energy</u>, <u>Rocky Flats Plant</u>.

#### Plutonium-239 and -240 Activity Concentrations in Onsite Ambient Air at Selected Locations<sup>a</sup>

Number of Volu		Volumed	Concentra	ution <sup>b</sup> (× 10 <sup>-1</sup>	s μCi/mx)c	Standard Deviation	Percent <sup>e</sup> of DCG
Station Analyses (× 1000 m <sup>3</sup> )	Cinin	C <sub>max</sub>	C <sub>mean</sub>	(C <sub>mean</sub> )	(C <sub>mcan</sub> )		
S-5	26	287	0.034	0.729	0.117	0.194	0.58
S-6	25	345	0.010	1.815	0.203	0.509	1.01
S-7	25	347	0.075	4.170	0.770	1.114	3.85
S-8	26	379	0.148	3.018	0.885	0.789	4.42
S-9	26	407	0.302	3.878	1.222	1.012	6.11
S-4	l	7	0.002	0.002	0.002		0.01
S-11	1	7	-0.001	-0.001	-0.001		-0.01
S-18	2	34	0.007	0.007	0.007		0.04

a. Air-sampling stations \$-5, \$-6, \$-7, \$-8, and \$-9 are located in areas where the potential for elevated airborne radioactivity is greatest (see Figure 7). Samples from stations S-4 (taken 12/15/87 to 12/21/87), S-11 (taken 1/6/87 to 1/13/87), and S-18 (taken 12/23/86 to 1/27/87) exceeded the screening guide of  $10 \times 10^{-15}$  µCi/mt total long-lived alpha activity. Specific plutonium analyses were performed on these samples. The results of these analyses are included for completeness.

b. Concentrations reflect monthly composites of station concentrations. C<sub>min</sub> = Minimum composited concentration; C<sub>max</sub> = Maximum composited concentration; C<sub>mean</sub> = Mean composited concentration.
 c. To obtain the proper concentration, multiply the numbers listed in the table by 1 x 10<sup>-15</sup> μCi/mg. For example, the

mean concentration at S-5 was  $0.117 \times 10^{-18} \mu \text{Ci/m}\text{e}$ .

d. To obtain the proper volume, multiply the numbers listed in the table by 1000 m<sup>3</sup>. For example, volume sampled at S-5 was 287,000 m<sup>3</sup>.

e. The interim standard calculated Derived Concentration Guide (DCG) for inhalation of class W plutonium by members of the public is 20 × 10<sup>-15</sup> µCi/m<sup>2</sup>. (See Appendix A.)

#### Plutonium-239 and -240 Activity Concentrations in Perimeter Ambient Air

		L.	Concentrat	tion (× 10 <sup>-13</sup>	Canada ad Dania di un	Percent <sup>c</sup> of DCG (C <sub>mean</sub> )	
	Volume <sup>b</sup> (x 1000 m <sup>3</sup> )	Cmin	C <sub>max</sub>	Cmean	Standard Deviation (C <sub>mean)</sub>		
S-31	11	294	0.000	0.013	0.003	0.004	0.02
S-32	12	313	-0.001	0.014	0.002	0.004	0.01
S-33	12	365	-0.001	0.004	0.001	0.002	0.01
S-34	12	321	-0.001	0.263	0.024	0.075	0.12
S-35	12	293	-0.001	0.018	0.003	0.006	0.02
S-36	12	355	0.001	0.022	0.007	0.006	0.04
S-37	12	351	0.002	0.011	0.007	0.003	0.04
S-38	12	362	0.000	0.018	0.005	0.005	0.02
S-39	12	388	-0.001	0.006	0.002	0.002	0.01
S-40	12	338	-0.001	0.010	0.003	0.003	0.02
S-41	12	321	0.000	0.009	0.003	0.003	0.02
S-42	12	35 <b>5</b>	-0.001	0.004	0.001	0.002	0.01
S-43	12	390	-0.001	0,006	0.002	0.002	0.01
S-44	12	355	-0.001	0.010	0.002	0.003	0.01
Summary	167		-0.001	0.263	_	-	_
Average	-	•		-	0.005	0.00857	0.03

a. To obtain the proper concentration, multiply the numbers listed in the table by  $1 \times 10^{-15} \ \mu \text{Ci/m}\text{s}$ . For example, the mean concentration at S-31 was  $0.003 \times 10^{-15} \ \mu \text{Ci/m}\text{s}$ .

b. To obtain the proper volume, multiply the number listed in the table by 1000 m<sup>3</sup>. For example, the volume sampled at S-31 was 294,000 m<sup>3</sup>.

c. The interim standard claculated Derived Concentration Guide (IXG) for inhalation of Class W plutonium by members of the public is  $20 \times 10^{-15} \ \mu\text{Ci/me}$ .

#### Plutonium-239 and -240 Concentrations in Community Ambient Air

			Concentr	ation (x 10-	<sup>5</sup> μCi/mℓ) <sup>2</sup>	6 1. 15	_ "
	Volume <sup>b</sup> (x 1000 m³)	C <sub>min</sub>	Cmax	C <sub>mean</sub>	Standard Deviation (C <sub>mean</sub> )	Percent <sup>c</sup> of DCG (C <sub>mean</sub> )	
Marshall	12	315	-0.001	0.005	0.002	0.002	0.01
Jeffco Airport	12	342	0.000	0.010	0.003	0.003	0.02
Superior	12	327	-0.001	0.004	0.001	0.002	0.01
Boulder	12	364	0.000	0.004	0.001	0.001	0.01
Lafayette	12	344	0.000	0.004	0.002	0.001	0.01
Broomfield	12	301	-0.001	0.008	0.002	0.003	0.01
Walnut Creek	12	384	-0.001	0.005	0.002	0.002	0.01
Wagner	12	<b>367</b>	0.000	0.007	0.003	0.003	0.02
Leyden	12	337	-0.001	0.008	0.001	0.002	0.01
Westminster	12	279	-0.002	0.299	0.026	0.086	0.13
Denver	12	31 <b>9</b>	-0. <b>006</b>	0.005	0.001	0.003	0.01
Golden	12	3 <b>63</b>	-0.001	0.007	0.001	0.003	0.01
Lakeview Pointe	12	3 <b>6.5</b>	0.000	0.008	0.002	0.002	0.01
Cotton Creek	12	345	-0.001	0.005	0.001	0.002	0.01
Summary	168		-0.006	0.299	_	-	
Average	-		-	-	0.003	0.00821	0.02

a. To obtain the proper concentration, multiply the numbers listed in the table by  $1 \times 10^{-15} \ \mu\text{Ci/mg}$ . For example, the mean concentration at Marshall was  $0.002 \times 10^{-15} \ \mu\text{Ci/mg}$ .

b. To obtain the proper volume, multiply the numbers listed in the table by 1000 m³. For example, the volume sampled at Marshall was 315,000 m³.

c. The interim standard calculated offsite Derived Concentration Guide (DCG) for inhalation of Class W plutonium by members of the public is  $20 \times 10^{-15} \ \mu\text{Ci/mv}$ .

#### ATTACHMENT 6D

#### RANGES OF NATURAL URANIUM AND TOTAL ALPHA CONCENTRATION IN WATER SAMPLES COLLECTED BY THE COLORADO DEPARTMENT OF HEALTH 1985

Sampling Station	Months Sampled	URANIUM (ug/l) (x 10	-9 uci/ml)	ALPHA (x 10 <sup>-9</sup> uCi/ml)
Pond A-3	Oct., Dec.	<3	<2	<4-11 <u>+</u> 4
Pond B-3	Nov., Dec.	<3	<2	<4
Walnut Creek at Indiana Street	Oct., Nov., Dec.	5.9-11.8	3.9-7.8	<5~10
Broomfield	Nov., Dec.	<3	<2	<4
Westminster	Nov., Dec.	<3	<2	<3
Arvada	Oct., Nov., Dec.	<3	<2	<2 <b>-</b> 2 <u>+</u> 2
Boulder	Dec.	<3	<2	<2
Golden	Nov.	<3	<2	<3
North Table Mountain	Oct., Nov., Dec.	<3-3.7	<2-2.5	<2

Source: Colorado Department of Health, 1985. <u>Environmental Surveillance Report on the U.S. Department of Energy Rocky Flats Plant. Monthly Information Exchange Meeting, December 1985.</u>

#### ATTACHMENT 7

AIR QUALITY DATA COLLECTED BY THE ROCKY FLATS PLANT 1987

Source: Rockwell International, 1987 [sic]. Annual Environmental Monitoring Report. U.S. Department of Energy, Rocky Flats Plant.

#### Plutonium-239 and -240 Activity Concentrations in Onsite Ambient Air at Selected Locations<sup>a</sup>

Number of Vo		Volumed	Concentra	ition <sup>b</sup> (x 10 <sup>-1</sup>	<sup>s</sup> μCi/mx) <sup>c</sup>	Standard Deviation	Percent <sup>e</sup> of DCG
Station Analyses (x 1000 m <sup>3</sup> )	Cinin	Cmax	Cmean	(C <sub>mean</sub> )	(C <sub>mean</sub> )		
S-5	26	287	0.034	0.729	0.117	0.194	0.58
S-6	25	3 <b>4.5</b>	0.010	1.815	0.203	0.509	1.01
S-7	25	347	0.075	4.170	0.770	1.114	3.85
S-8	26	37 <b>9</b>	0.148	3.018	0.885	0.789	4.42
S-9	26	407	0.302	3.878	1.222	1.012	6.11
S-4	ŧ	7	0.002	0.002	0.002		0.01
S-11	1	7	-0.001	~0.001	-0.001		-0.01
S-18	2	34	0.007	0.007	0.007		0.04

a. Air-sampling stations S-5, S-6, S-7, S-8, and S-9 are located in areas where the potential for elevated airborne radioactivity is greatest (see Figure 7). Samples from stations S-4 (taken 12/15/87 to 12/21/87), S-11 (taken 1/6/87 to 1/13/87), and S-18 (taken 12/23/86 to 1/27/87) exceeded the screening guide of  $10 \times 10^{-13}$   $\mu$ Ci/mv total long-lived alpha activity. Specific plutonium analyses were performed on these samples. The results of these analyses are included for completeness.

b. Concentrations reflect monthly composites of station concentrations. C<sub>min</sub> = Minimum composited concentration; C<sub>max</sub> = Maximum composited concentration; C<sub>mean</sub> = Mean composited concentration.
 c. To obtain the proper concentration, multiply the numbers listed in the table by 1 x 10<sup>-15</sup> μCi/mx. For example, the

mean concentration at S-5 was 0.117 × 10<sup>-13</sup> µCi/mv.

d. To obtain the proper volume, multiply the numbers listed in the table by 1000 m<sup>3</sup>. For example, volume sampled at S-5 was 287,000 m<sup>3</sup>.

e. The interim standard calculated Derived Concentration Guide (DCG) for inhalation of class W plutonium by members of the public is  $20 \times 10^{-15} \,\mu\text{Ci/m}$ ?. (See Appendix A.)

#### Plutonium-239 and -240 Activity Concentrations in Perimeter Ambient Air

		la.	Concentration (x 10 <sup>-15</sup> μCi/me) <sup>a</sup>			Standard Deviation	because exact
	Volume <sup>b</sup> (× 1000 m <sup>3</sup> )	Cmin	Cmax	Cmean	(C <sub>mean</sub> )	Percent <sup>c</sup> of DCG (C <sub>mean</sub> )	
S-31	11	294	0.000	0.013	0.003	0.004	0.02
S-32	12	313	-0.001	0.014	0.002	0.004	0.01
S-33	1.2	36 <b>.5</b>	-0.001	0.004	0.001	0.002	0.01
S-34	12	321	-0.001	0.263	0.024	0.075	0.12
S-35	12	293	-0.001	0.018	0.003	0.006	0.02
S-36	12	355	0.001	0.022	0.007	0.006	0.04
S-37	12	351	0.002	0.011	0.007	0.003	0.04
S-38	12	362	0.000	0.018	0.005	0.005	0.02
S-39	12	388	-0.001	0.006	0,002	0,002	0.01
S-40	12	338	-0.001	0.010	0.003	0.003	0.02
S-41	12	321	0.000	0.009	0.003	0.003	0.02
S-42	12	35 <b>5</b>	-0.001	0.004	0.001	0.002	0.01
S-43	. 12	390	-0.001	0.006	0.002	0.002	0.01
S-44	12	3 <b>55</b>	-0.001	0.010	0.002	0.003	0.01
Summary	167		-0.001	0.263	_	-	_
Average	-	-		-	0.005	0.00857	0.03

a. To obtain the proper concentration, multiply the numbers listed in the table by  $1 \times 10^{-15} \ \mu\text{Ci/mg}$ . For example, the mean concentration at S-31 was  $0.003 \times 10^{-15} \ \mu\text{Ci/mg}$ .

b. To obtain the proper volume, multiply the number listed in the table by 1000 m<sup>3</sup>. For example, the volume sampled at S-31 was 294,000 m<sup>3</sup>.

c. The interim standard claculated Derived Concentration Guide (ECG) for inhalation of Class W plutonium by members of the public is  $20 \times 10^{-15} \ \mu\text{Ci/me}$ .

#### Plutonium-239 and -240 Concentrations in Community Ambient Air

		<b>h</b>	Concentration (x 10-15 µCi/me) <sup>ii</sup>			Canadaad Darintina	
Station	Number of Analyses	Volume <sup>b</sup> (x 1000 m <sup>3</sup> )	C <sub>min</sub>	C <sub>max</sub>	C <sub>mean</sub>	Standard Deviation (C <sub>mean</sub> )	Percent <sup>c</sup> of DCG (C <sub>mean</sub> )
Marshall	12	315	-0.001	0.005	0.002	0.002	0.01
Jeffeo Airport	12	342	0.000	0.010	0.003	0.003	0.02
Superior	12	327	-0.001	0.004	0.001	0.002	0.01
Boulder	12	364	0.000	0.004	0.001	0.001	0.01
Lafayette	12	344	0.000	0.004	0.002	0.001	0.01
Broomfield	12	301	-0.001	0.008	0.002	0.003	0.01
Walnut Creek	12	384	-0.001	0.005	0.002	0.002	0.01
Wagner	12	367	0.000	0.007	0.003	0.003	0.02
Leyden	12	337	-0.001	0.008	0.001	0.002	0.01
Westminster	12	279	-0.002	0.299	0.026	0.086	0.13
Denver	12	31 <b>9</b>	-0.006	0.005	0.001	0.003	0.01
Golden	12	363	-0.001	0.007	0.001	0.003	0.01
Lakeview Pointe	12	3 <b>6 S</b>	0.000	0.008	0.002	0.002	0.01
Cotton Creek	12	3 <b>45</b>	-0.001	0.005	0.001	0.002	0.01
Summary	168		-0.006	0.299	_		-
Average	-		-	-	0.003	0.00821	0.02

a. To obtain the proper concentration, multiply the numbers listed in the table by  $1 \times 10^{-15} \ \mu\text{Ci/m}\text{s}$ . For example, the mean concentration at Marshall was  $0.002 \times 10^{-15} \ \mu\text{Ci/m}\text{s}$ .

b. To obtain the proper volume, multiply the numbers listed in the table by 1000 m<sup>2</sup>. For example, the volume sampled at Marshall was 315,000 m<sup>3</sup>.

c. The interim standard calculated offsite Derived Concentration Guide (DCG) for inhalation of Class W plutonium by members of the public is  $20 \times 10^{-15} \ \mu\text{Ci/my}$ .

#### Onsite Ambient Air Quality Data

#### (Nonradioactive Parameters) 1987

Total Suspended Particulates (µg/m³)	
Total Number of Samples - "A"	60
Total Number of Samples - "B"b	58
Geometric Mean, Sampler "A"	40.9
Geometric Mean, Sampler "B"	39.2
Standard Deviation, Sampler "A"	21.8
Standard Deviation, Sampler "B"	21.5
Observed 24-Hour Maximum, "A"	100.1
Observed 24-Hour Maximum, "B"	97.2
Second Highest Maximum, "A"	97.5
Second Highest Maximum, "B"	96.5
Lowest Observed Value, "A"	8.8
Lowest Observed Value, "B"	5.2
Ozone (ppm)	
Number of Observations, Hourly c	8,143
Arithmetic Mean, Annual	0.036
Maximum 1-Hour Concentration	0.135
Second Highest 1-Hour Concentration	0.134
Minimum Observation, Hourly	0.003
Carbon Monoxide (ppm)	
Number of Observations, Hourly <sup>C</sup>	8,400
Arithmetic Mean, Annual	0.69
Maximum 1-Hour Concentration	6.50
Second Highest 1-Hour Concentration	4.90
Maximum 8-Hour Concentration	2.30
Minimum Hourly Observation	0.05
Nitrogen Dioxide (ppm)	
Number of Observations, Hourly c	7.500
Arithmetic Mean	0.005
Maximum 1-Hour Concentration	0. <b>064</b>
Minimum Hourly Observation	0.001
Sulfur Dixoide (ppm)	
Number of Observations, Hourly <sup>C</sup>	8,284
Arithmetic Mean, Annual	0.003
3-Hour Average, Highest	0.021
24-Hour Average, Highest	0.010

#### Air borne Lead (µg/m³)

Total Number	Jan-Mar	Apr-June	Jul-Sep	Oct-Dec
of Samples	6	7	6	6
Quarterly Avg.	0.015	0.033	0.018	0.010

a. Primary ambient air particluate sampler.

b. Co-Located duplicate sampler.

c. Continuous millivolt analyzer output is composited and converted to engineering units for comparison to NAAQS (see Table 8).

CO7890010526

Date: 5 October 1988 Revision No. 1 Appendix I-1

#### ATTACHMENT 8

AIR QUALITY DATA COLLECTED BY THE COLORADO DEPARTMENT OF HEALTH

Source: Colorado Department of Health, 1985. <u>Environmental Surveillance Report on the U.S. Department of Energy Rocky Flats Plant. Monthly Information Exchange Meeting, December.</u>

#### ATTACHMENT 8A

#### RANGES OF RADIOACTIVE PARAMETERS IN AIR SAMPLES COLLECTED BY THE COLORADO DEPARTMENT OF HEALTH 1984-1985

Sampling <u>Areas</u>	Total Long-lived Alpha (x 10 <sup>-15</sup> uCi/ml)	Total Long-lived Beta (x 10 <sup>-15</sup> uCi/ml)	Pu 239+ 240 (x 10 <sup>-15</sup> uCi/ml)
On-Site (Security) 1984	<1-16	<10-140	VD.
1985	<1-15	<10-140	ND <0.02-0.24 <u>+</u> 0.11 <sup>2</sup>
On-Site (Perimeter) 1985	1-81	<10-110 <sup>1</sup>	<0.02-1.5 ±0.10 <sup>2</sup>
Off-Site (Metropolita:	•		
1984 1985	<1-16 <1-15	<10-140 <10-120	ND ND
Off-Site (Remote)			
1984 1985	<4-31 <4-16	<10-220 20-160	ND ND

<sup>&</sup>lt;sup>1</sup>Data collected during December only.
<sup>2</sup>Data collected during June and July only.

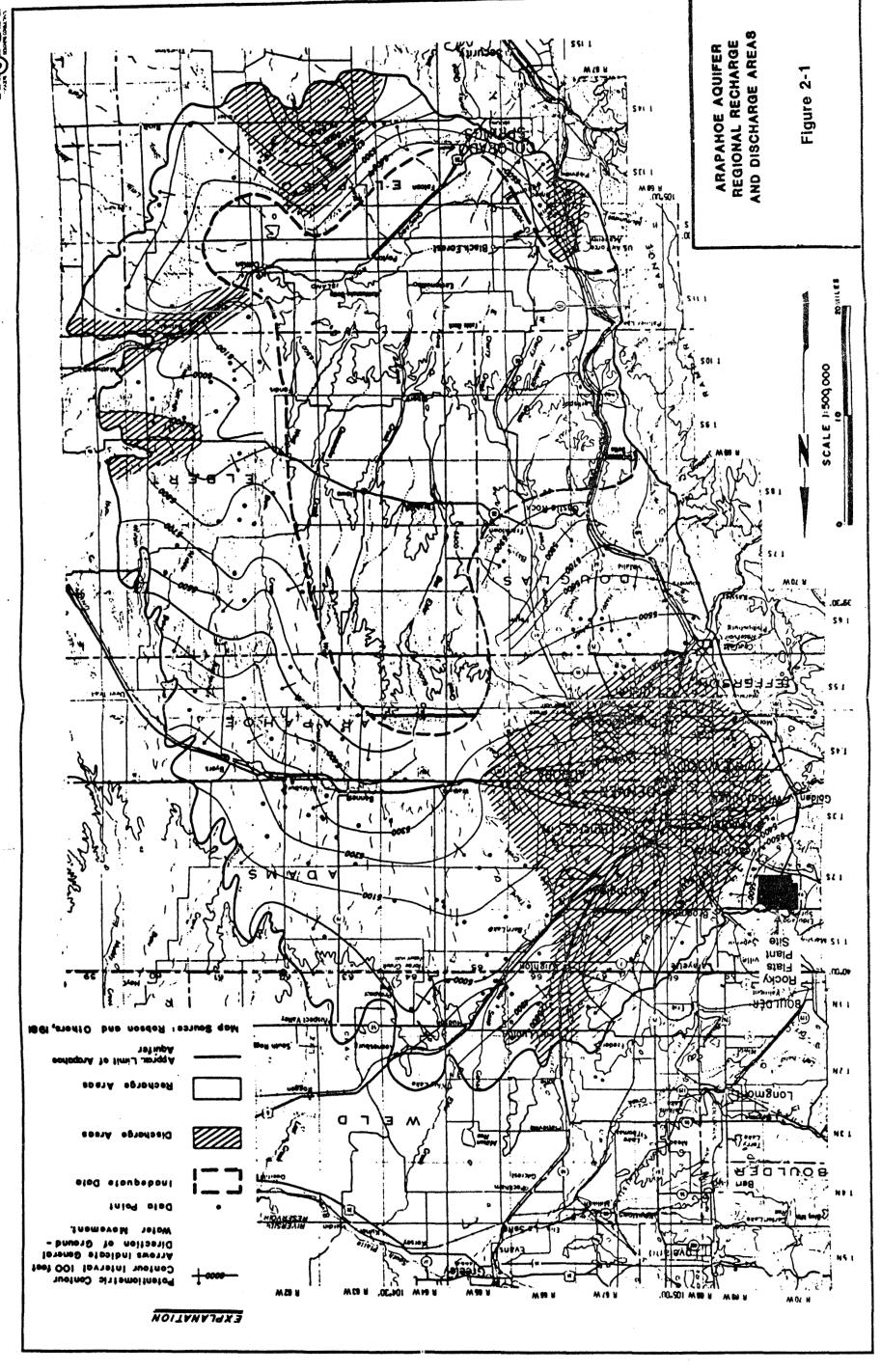
#### ATTACHMENT 8B

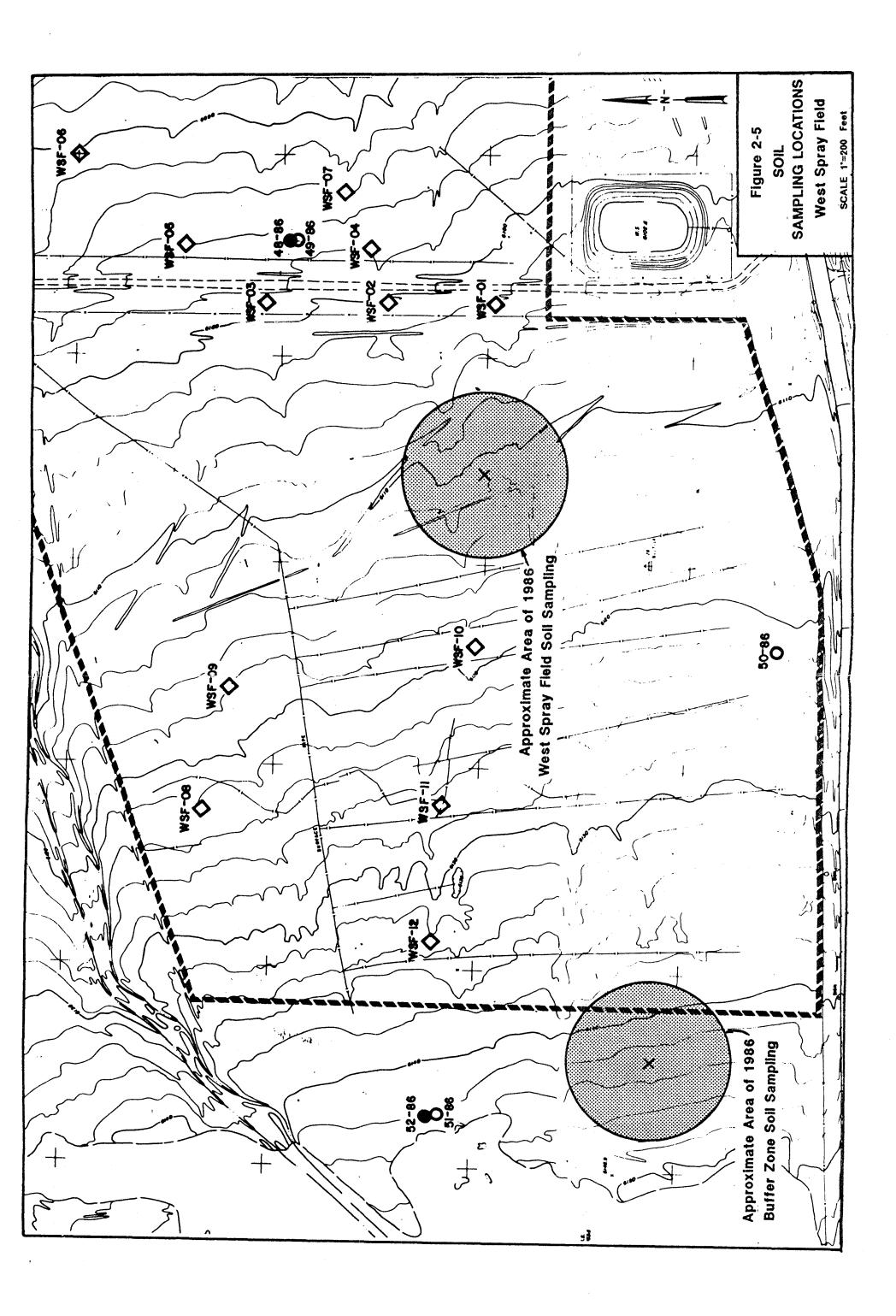
### LOCATIONS OF COLORADO DEPARTMENT OF HEALTH OFF-SITE AIR MONITORING STATIONS

Metropolitan:	Broomfield Adams City Arvada Aurora Boulder Denver Denver Castle Rock Englewood Golden Lakewood Longmont	4301 E. 72nd Ave 8101 Ralston Road 1633 Florence St. 13th and Spruce 414 14th Street 1050 S.Broadway 310 3rd Street 4857 S. Broadway 911 10th street 260 S. Kipling City Hall
Remote (background):	Durango Fort Collins Lamar Leadville Rangely	Fire Station 200 W. Oak Power Plant 510 Harrison Ave. High School

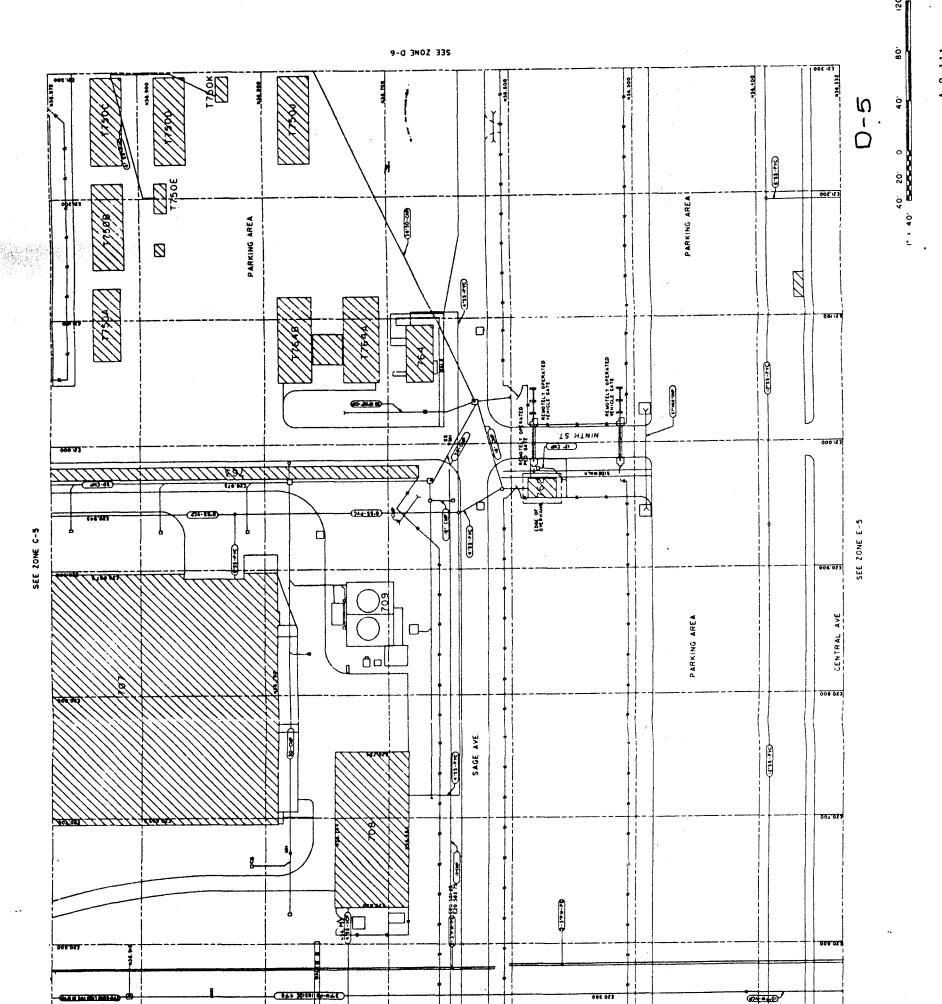
#### ATTACHMENT 9

DIAGRAMS OF PROCESS WASTE AND SANITARY SEWER CONDUITS AT THE ROCKY FLATS PLANT





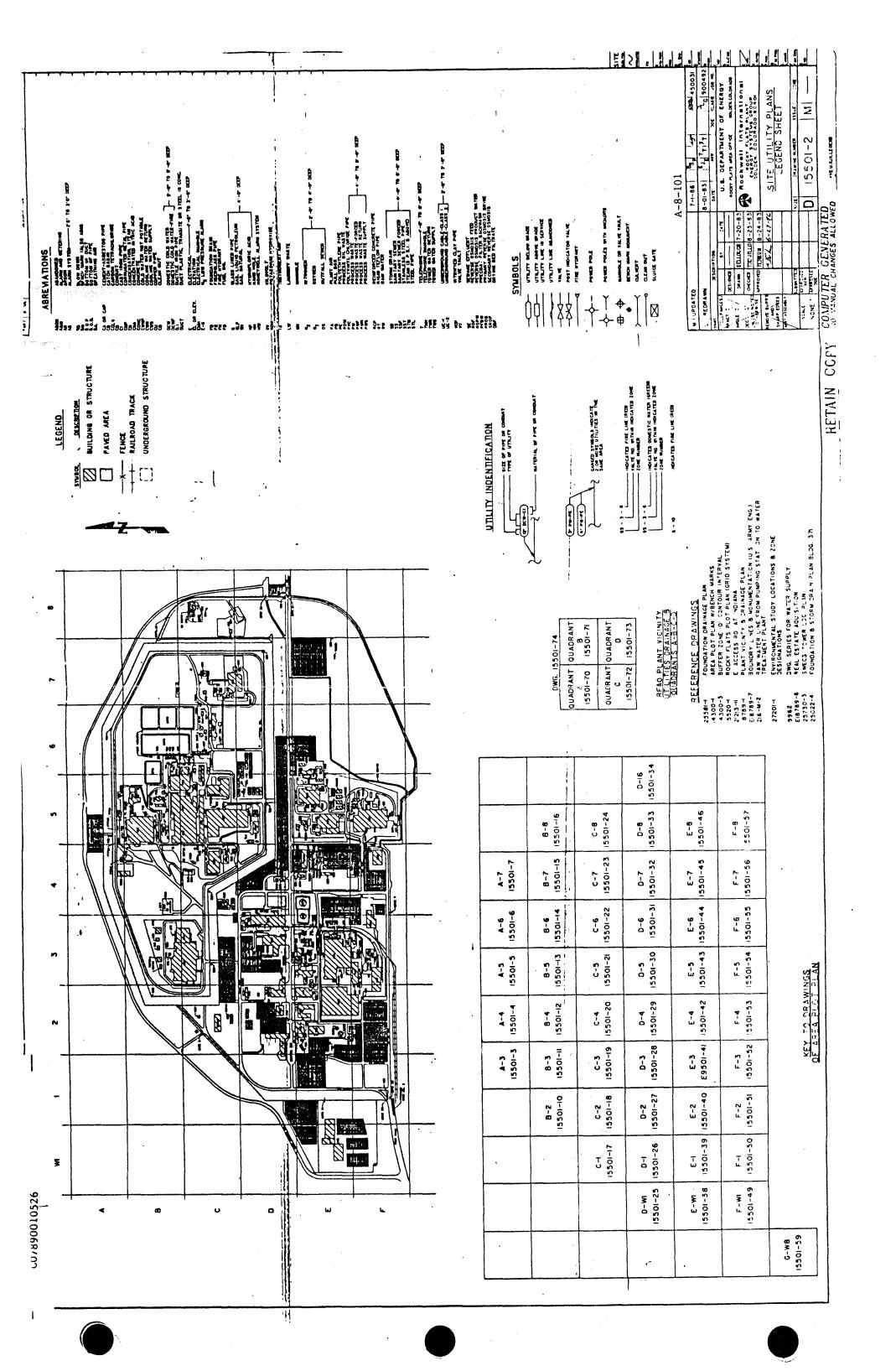
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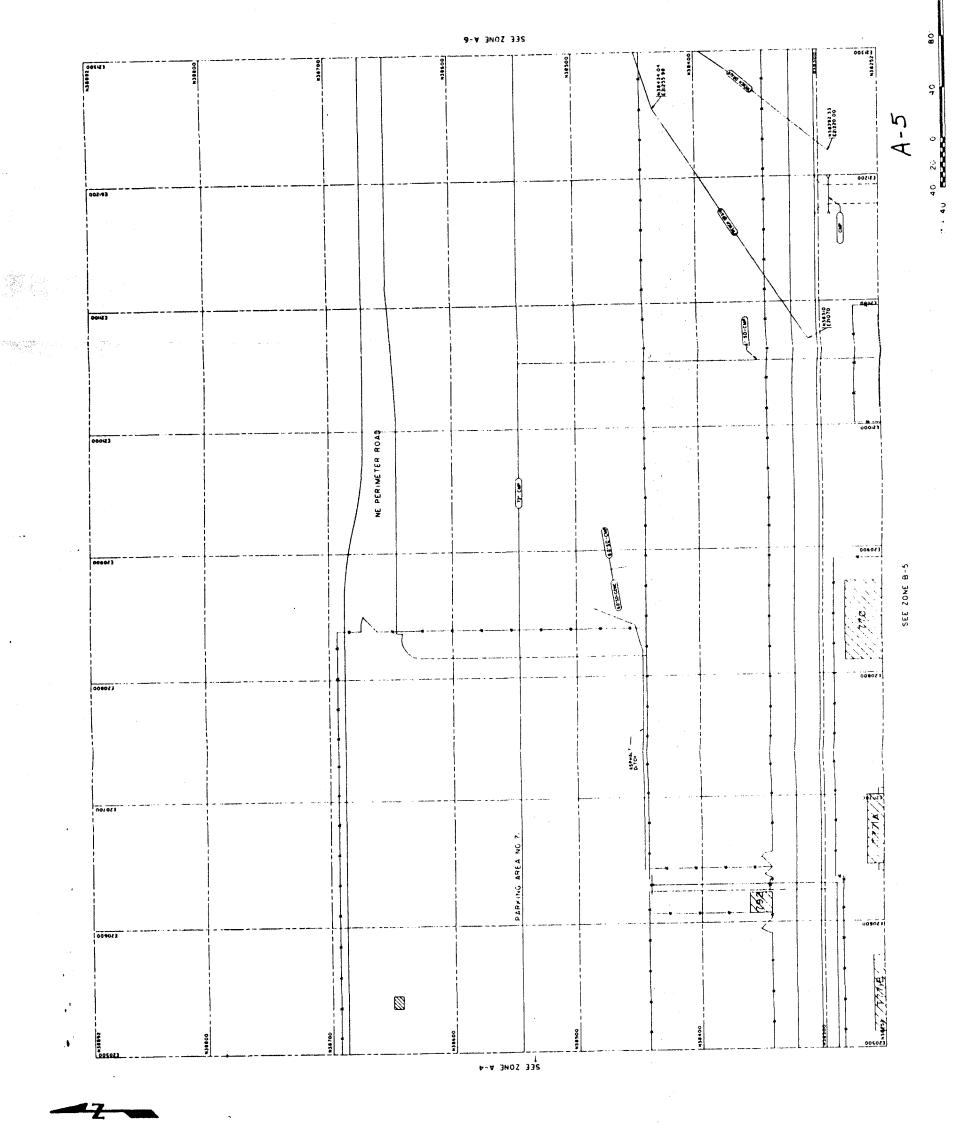


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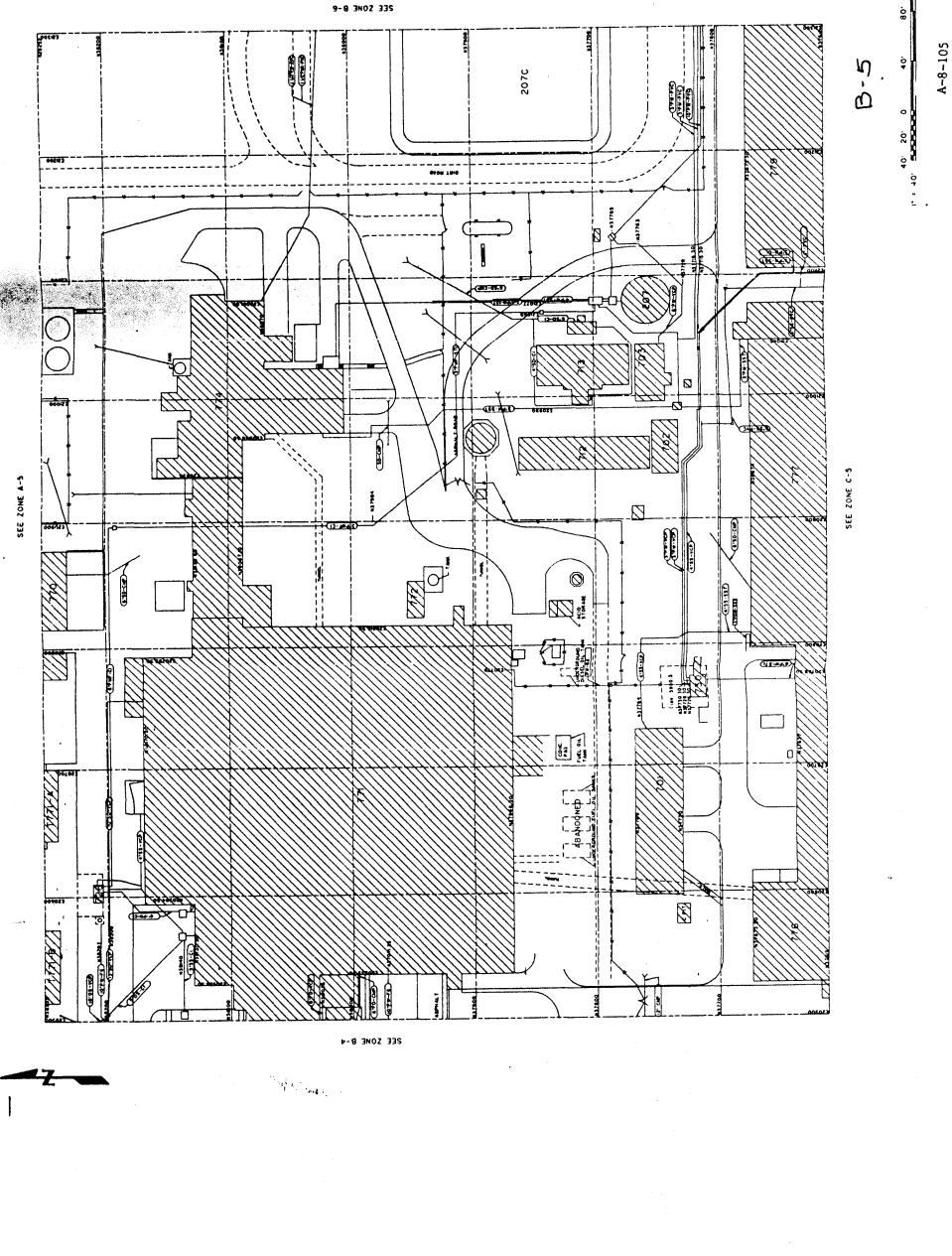
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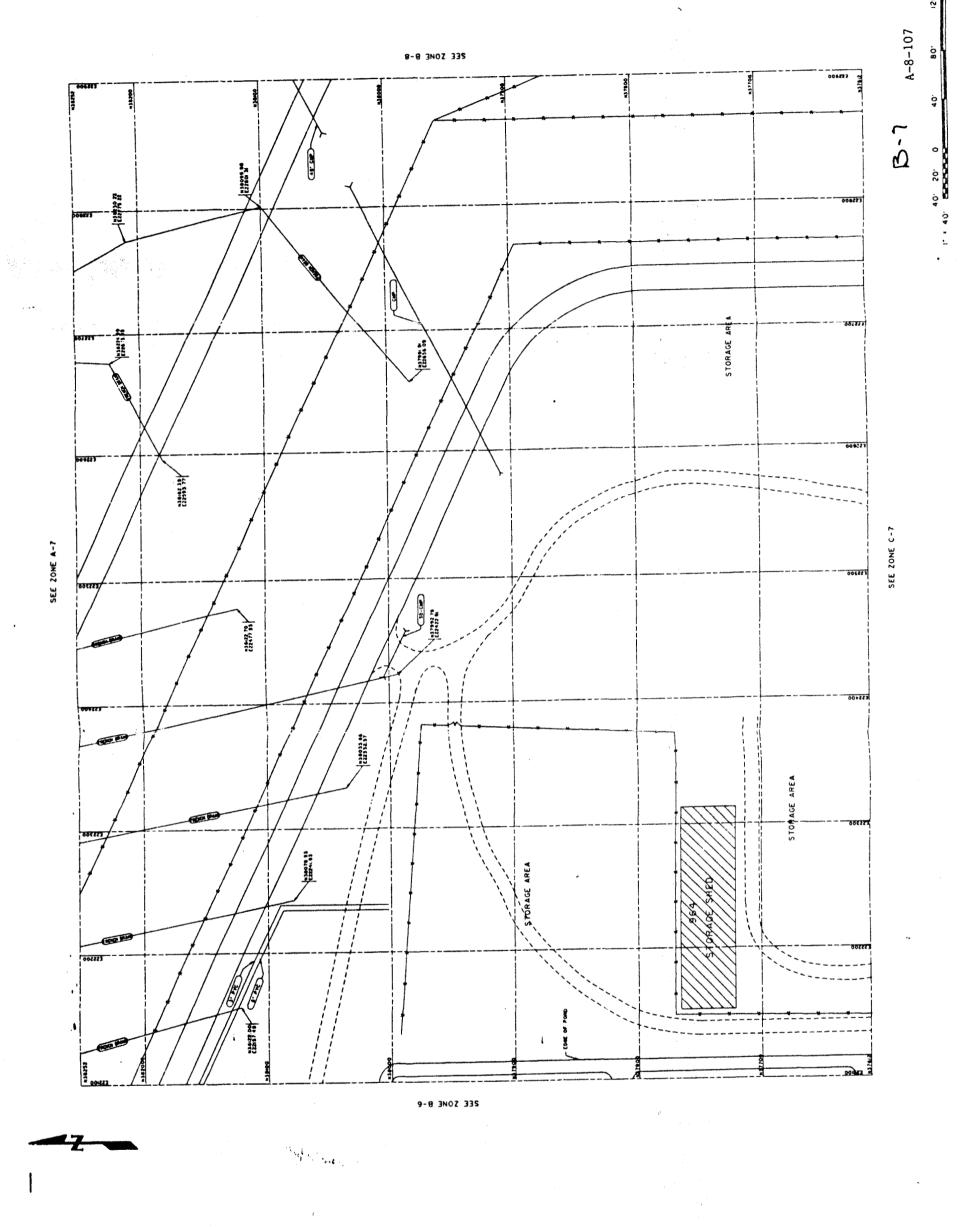
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